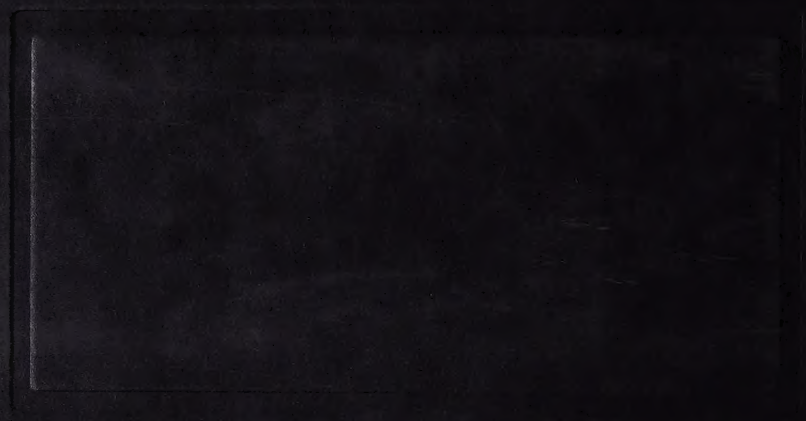
ALIGNMENT PROCEDURES

FIELD INTENSITY METER

MODEL FIM

For Boeing Airplane Co. % R. Royer.



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PROVEN RELIABILITY

ALIGNMENT PROCEDURES

FIELD INTENSITY METER

MODEL FIM

POLARAD ELECTRONICS CORPORATION

43-20 34th STREET • LONG ISLAND CITY 1 • NEW YORK, N. Y.

ALIGNMENT OF THE MODEL F I M FIELD INTENSITY METER

This section covers the alignment procedures for the Model FIM Field Intensity Receiver. The following steps, when properly carried out in the order listed, will be the equivalent of the factory alignment procedure.

Steps requiring special equipment, or extensive experience and familiarity with the Model FIM Field Intensity Meter, have been omitted from this procedure. If after performing the steps listed in this section, the equipment does not come up to specifications, it should be returned to the factory for repairs.

WARNING

DANGEROUS VOLTAGES EXIST WITHIN THIS EQUIPMENT. AVOID WORKING WITHIN THE SET WITH THE POWER ON. EXERCISE EXTREME CAUTION WHEN WORKING WITH THE POWER ON. TURN OFF THE POWER BEFORE MAKING CONNECTIONS WITHIN THE SET.

ADJUSTMENT AND ALIGNMENT PROCEDURES FOR THE MODEL FIM MICROWAVE FIELD INTENSITY METER

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ADJUSTMENT AND ALIGNMENT PROCEDURES FOR

THE MODEL FIM MICROWAVE FIELD INTENSITY METER

The following procedures shall be used to align and adjust the various circuits of the Model FIM Microwave Field Intensity Meter and Receiver.

I. POWER SUPPLY CHECK: (See figures 1-1 through 1-4.)

Check the power supply circuits for proper operation as directed below:

a. Interconnect the monitor unit, the tuning unit, and the power supply.

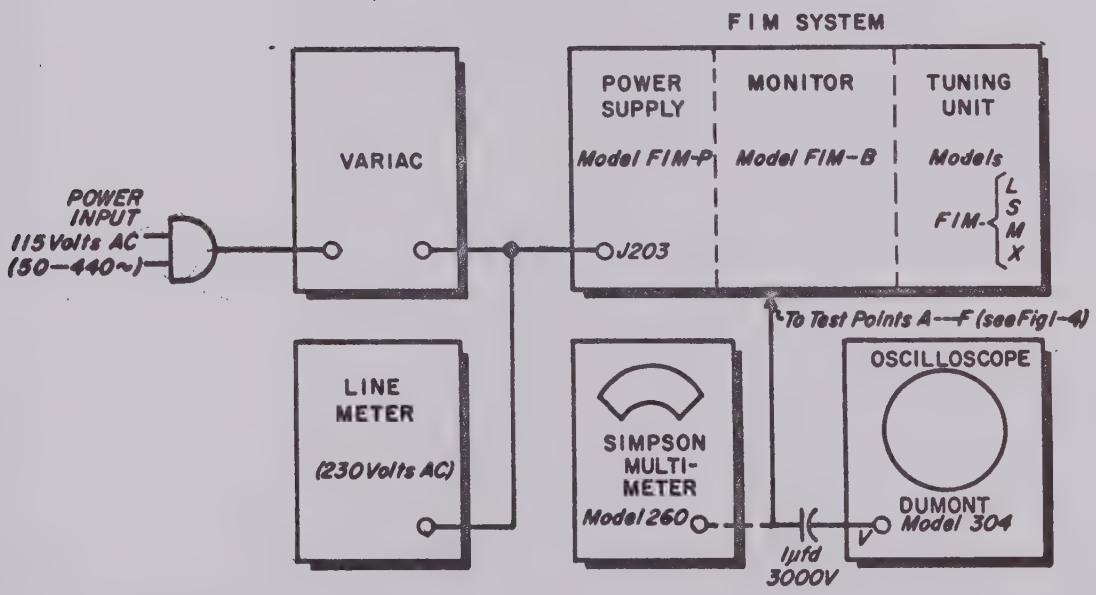


Figure 1-1. Test Setup, Power Supply Alignment, FIM System

b. Throw the POWER switch to the ON position. On the Power Unit, rotate the KLYSTRON CATHODE CURRENT switch to the LOCAL OSCILLATOR position.

c. Connect an accurate AC voltmeter to the two test jacks just forward of 93V ADJ R270.

d. If 93 volts ac is not indicated, adjust R270 until a 93-volt reading is obtained.

e. Check the power supply voltages in each position of the VOLTMETER switch. Correct voltages should be indicated within 20 seconds after the POWER switch is turned on, when the VOLTMETER switch is placed in the BIAS, LOW VOLTAGE, or REPELLER position. In the BEAM position, allow approximately one minute for the beam supply voltage to come on.

f. These voltages, when measured at the points indicated in Table 1-1, should give the results listed in Table 1-1. Ripple and breakout are measured with the test setup of figure 1-1. Breakout is that point where the supply goes out of regulation. This can be observed on the oscilloscope screen as that point where the ripple suddenly increases, to a value much higher than specification.

g. Repeat steps c through f with the KLYSTRON CATHODE CURRENT switch in the SIGNAL CALIBRATOR position.

Table 1-1. Power Supply Data

Supply	Voltage	Ripple (mv)	Breakout (volts)	Test Points (See figure 1-4)
BEAM				
BAND 1	-325 ±10%	<70mv; (<10mv*)	115±22v	A and ground
BAND 2	-325 ±10%	<70mv; (<10mv*)	115±22v	A and ground
BAND 3	-1000 ±10%	<75mv; (<30mv*)	115±22v	A and ground
BAND 4	-1250 ±10%	<75mv; (<50mv*)	115±22v	A and ground
REPELLER	650±20v	<60 mv	115±22v	B and A
-108v	-108±2v	<25mv	115±22v	D and ground
+130v	+130±3v	<30mv	115±22v	E and ground
+108v	+108±2v	<250mv	115±22v	F and ground

* With KLYSTRON CATHODE CURRENT switch in the SIGNAL CALIBRATOR position.

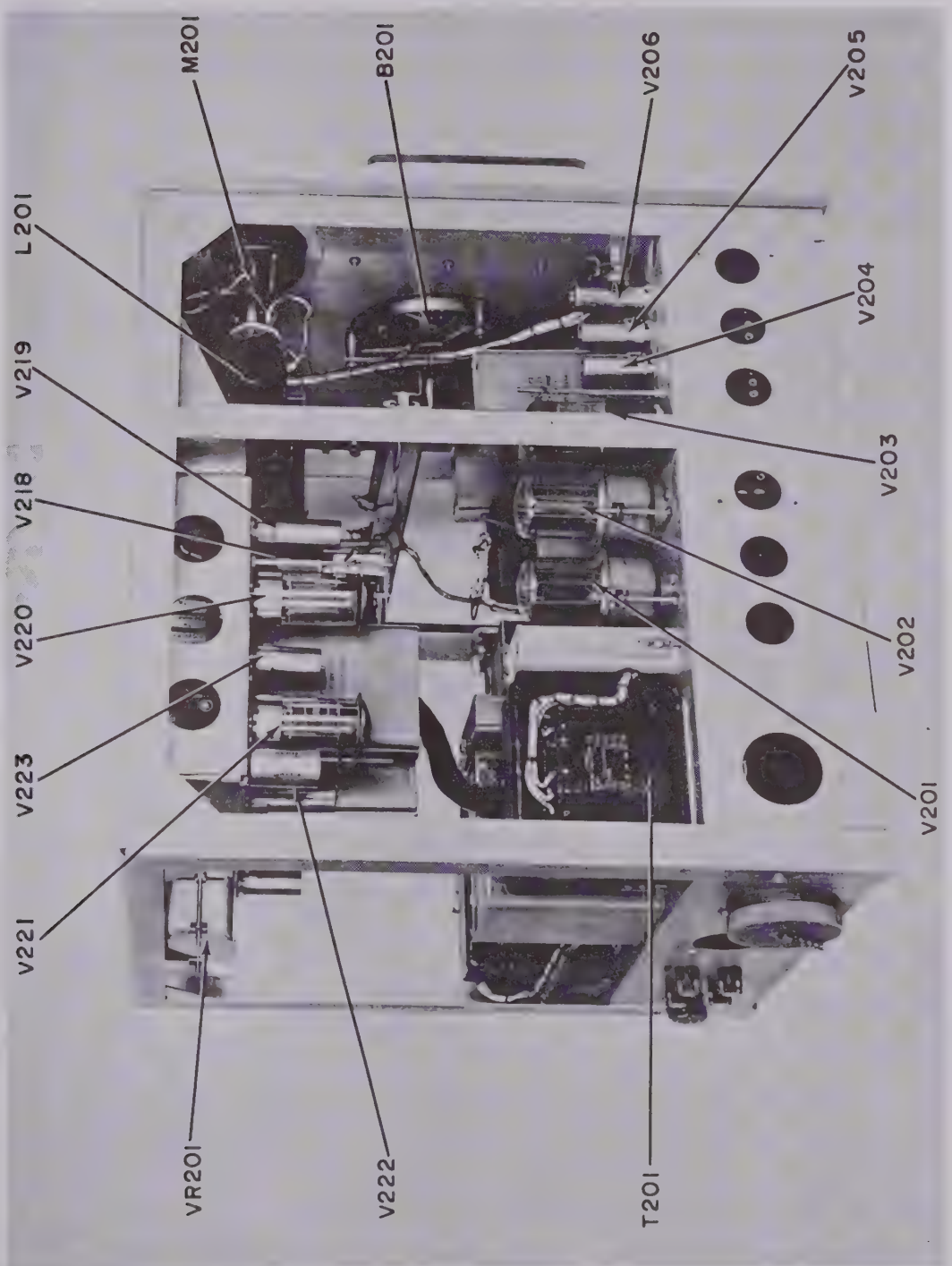


Figure 1-2. Power Unit, Right Side View, Parts Location Diagram

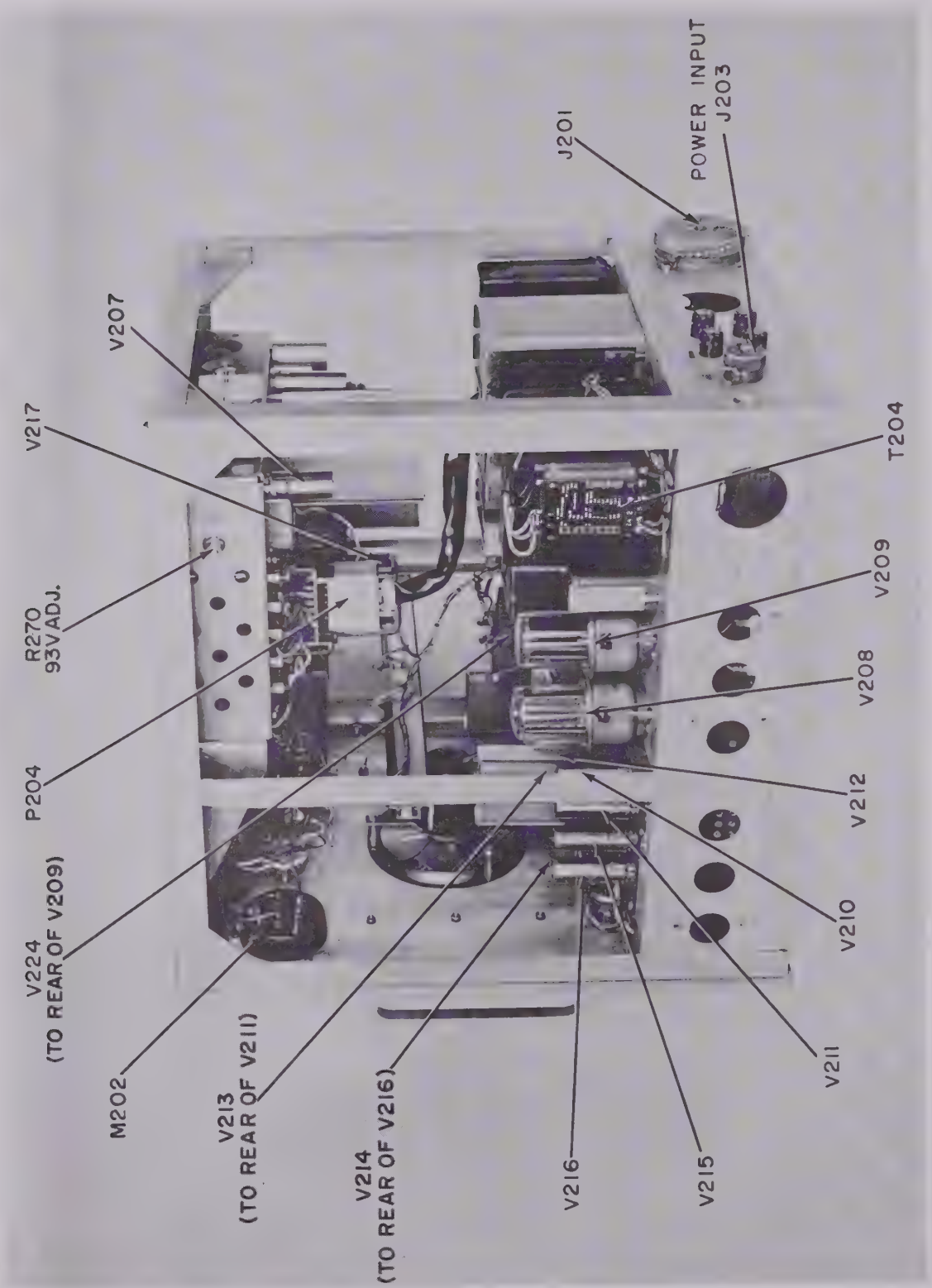


Figure 1-3. Power Unit, Left Side View, Parts Location Diagram

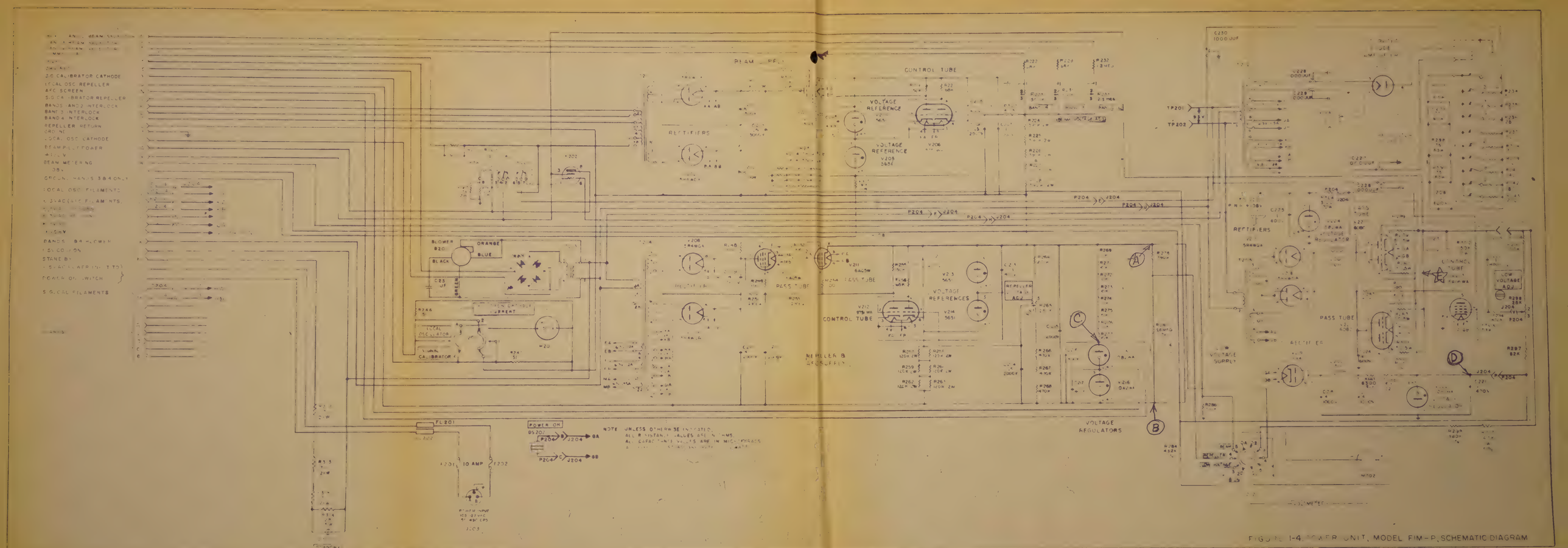


FIGURE 1-4. POWER UNIT, MODEL FIM-P, SCHEMATIC DIAGRAM

II. CRYSTAL CONTROLLED LOCAL OSCILLATOR ALIGNMENT: (Refer to figures 2-1 through 2-7.)

To accurately align the crystal controlled local oscillator circuit, proceed as follows:

a. Connect a d-c vacuum tube voltmeter, through a 1-megohm resistor, between pin 2 of V17 and ground.

b. Adjust L86 for a maximum indication on the vtvm.

c. Reconnect the vtvm between pin 1 of V18 and ground.

d. Adjust L87 for a maximum indication on the vtvm.

e. Reconnect the vtvm between pin 1 of V19 and ground.

f. Adjust L89 for a maximum indication on the vtvm.

g. Connect a 50-ohm detector from 180MC output connector J9 to ground. Figure 2-2 is the schematic diagram of a suitable detector.

h. Connect a vtvm to the output of the detector and adjust T4 for a maximum indication on the vtvm.

i. Reconnect the 50-ohm detector from 120 mc output J10 to ground.

j. Connect the vtvm to the output of the detector and adjust T5 for a maximum indication. The voltage reading at these points should be approximately 1 to 1.5 volts.

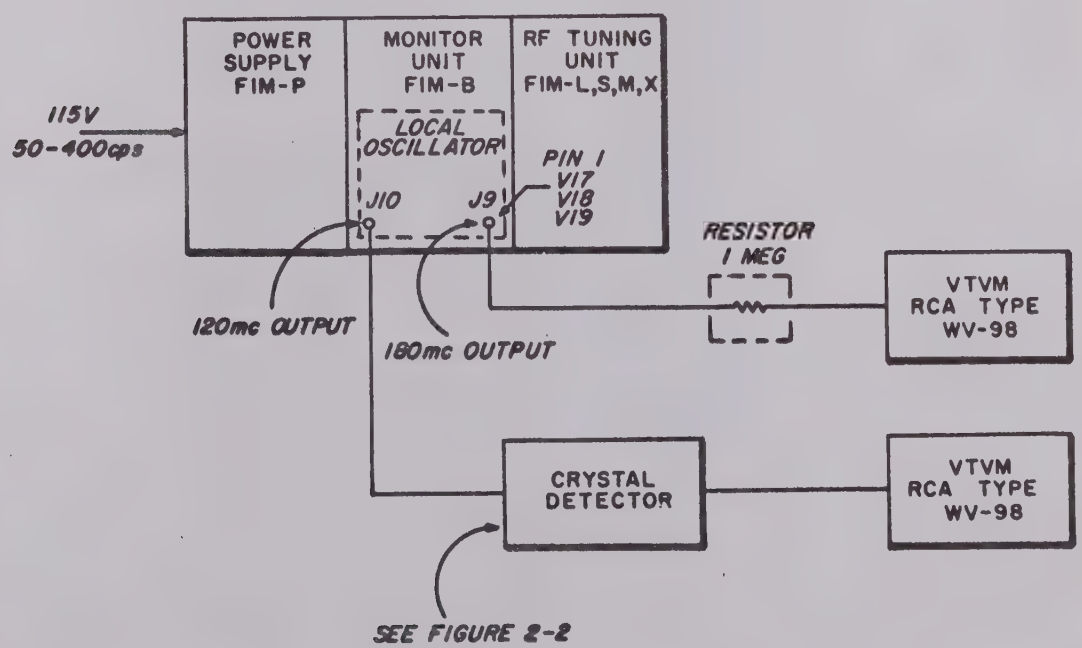


Figure 2-1. Test Set-Up, Crystal Controlled Local Oscillator.

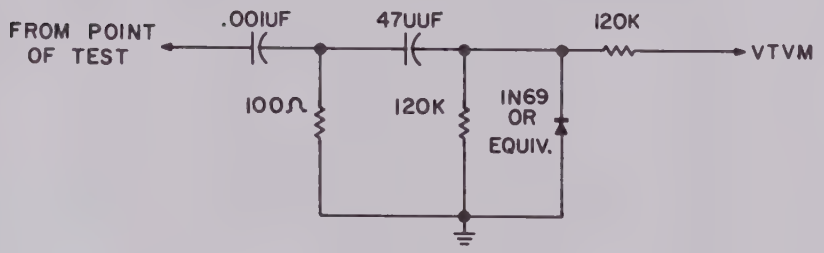


Figure 2-2. Crystal Detector

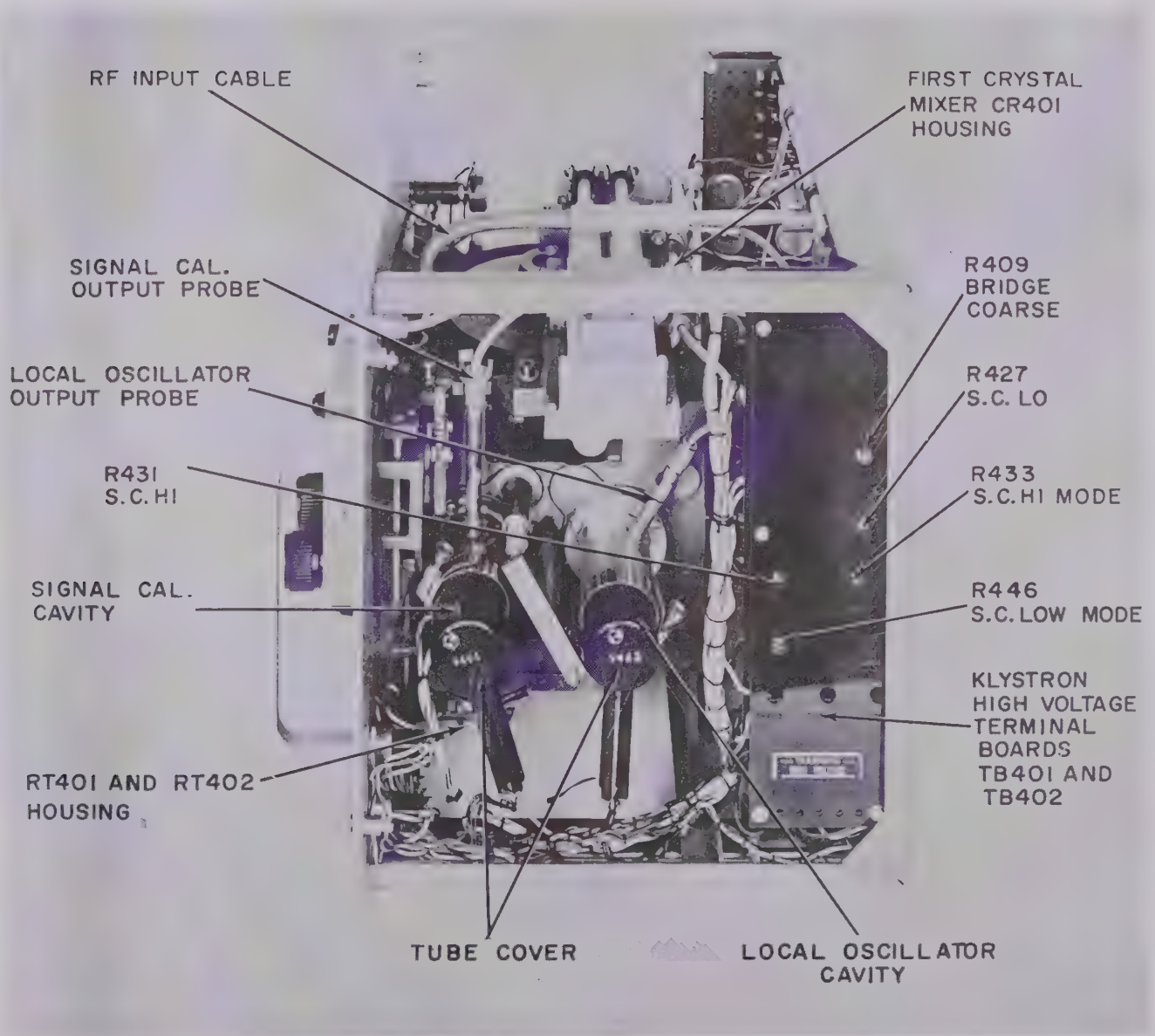


Figure 2-3. Typical Tuning Unit, Left Side View of Chassis

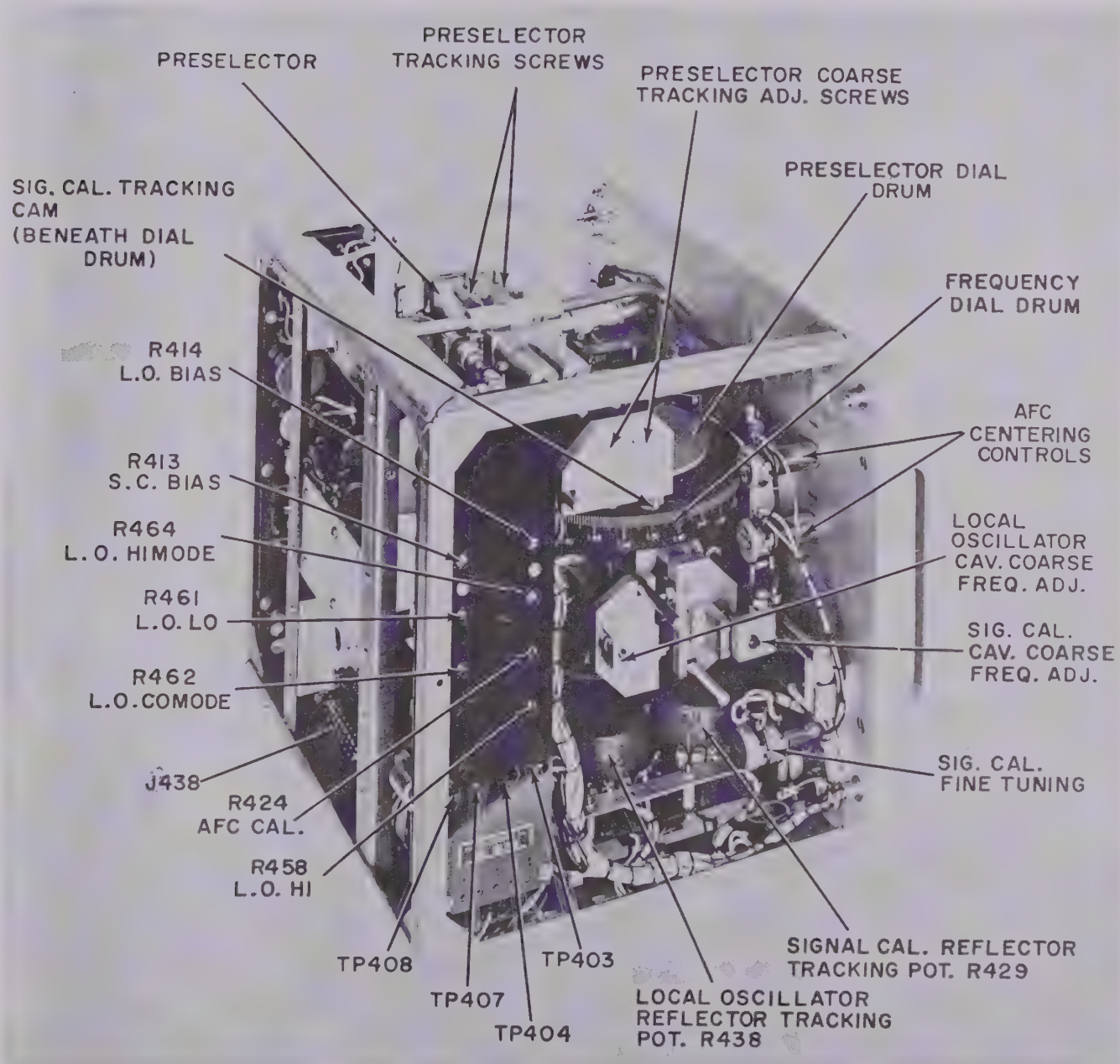


Figure 2-4. Typical Tuning Unit, Right Side View of Chassis

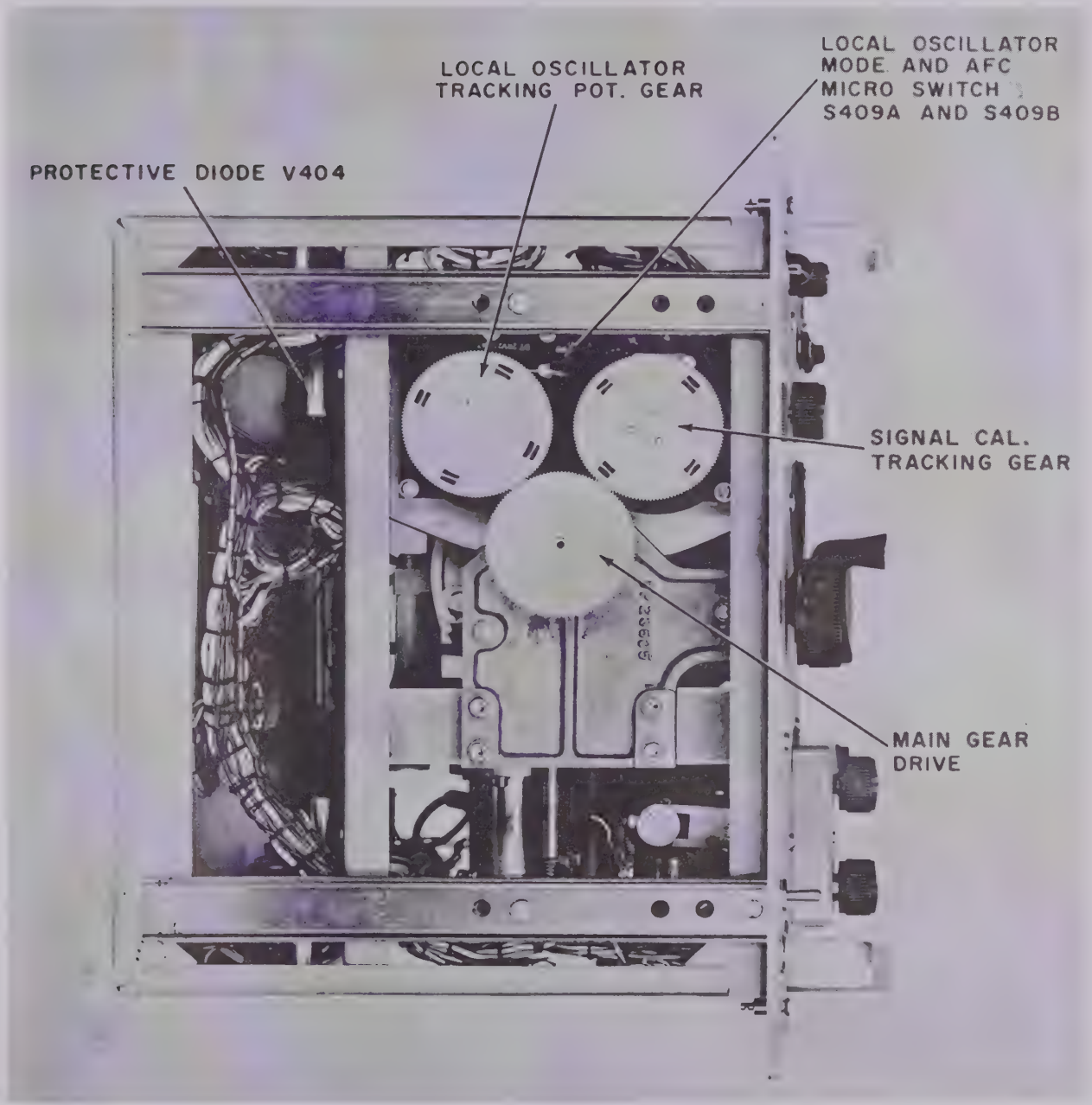


Figure 2-5. Typical Tuning Unit, Bottom View of Chassis

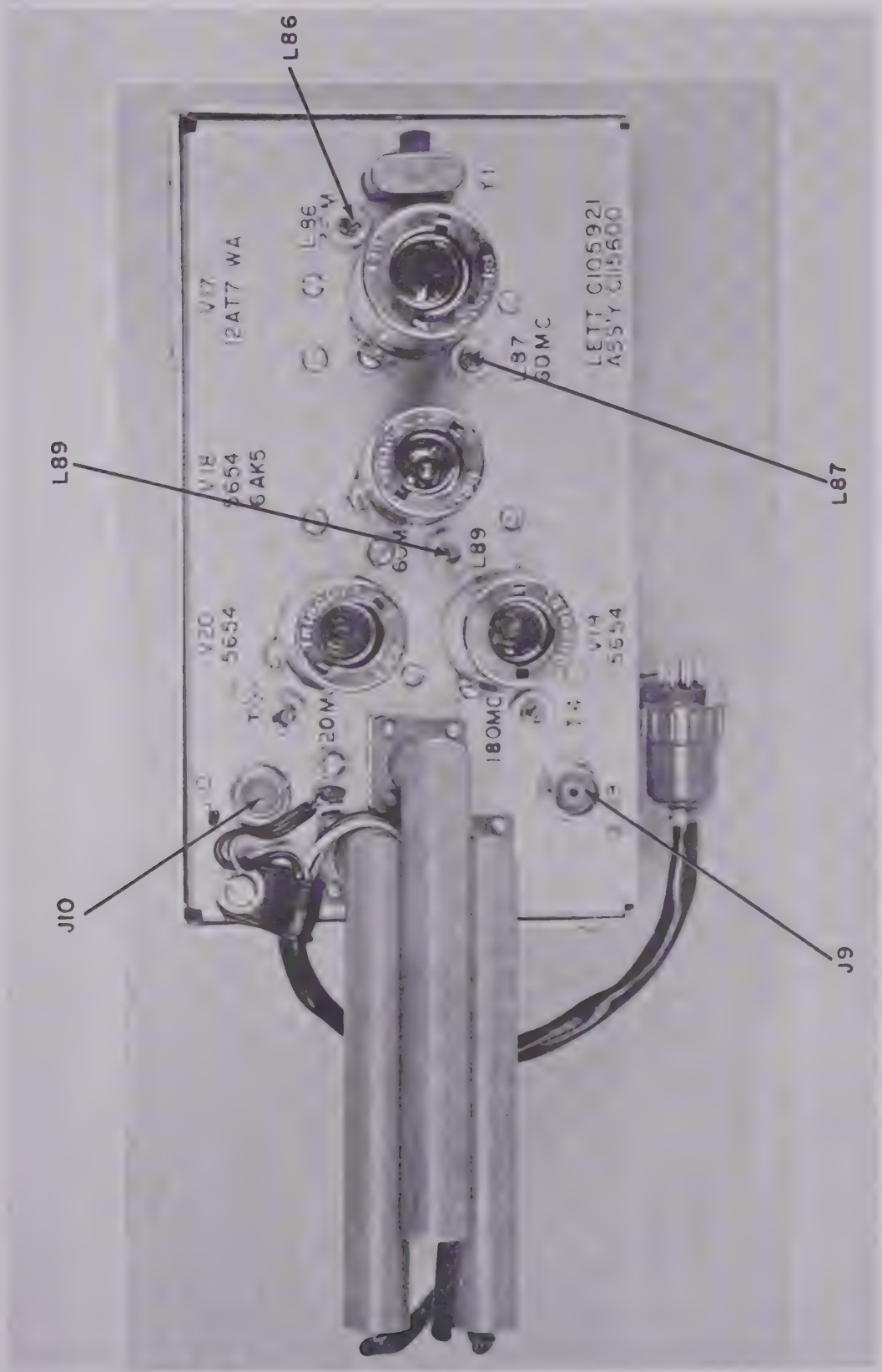


Figure 2-6. Local Oscillator

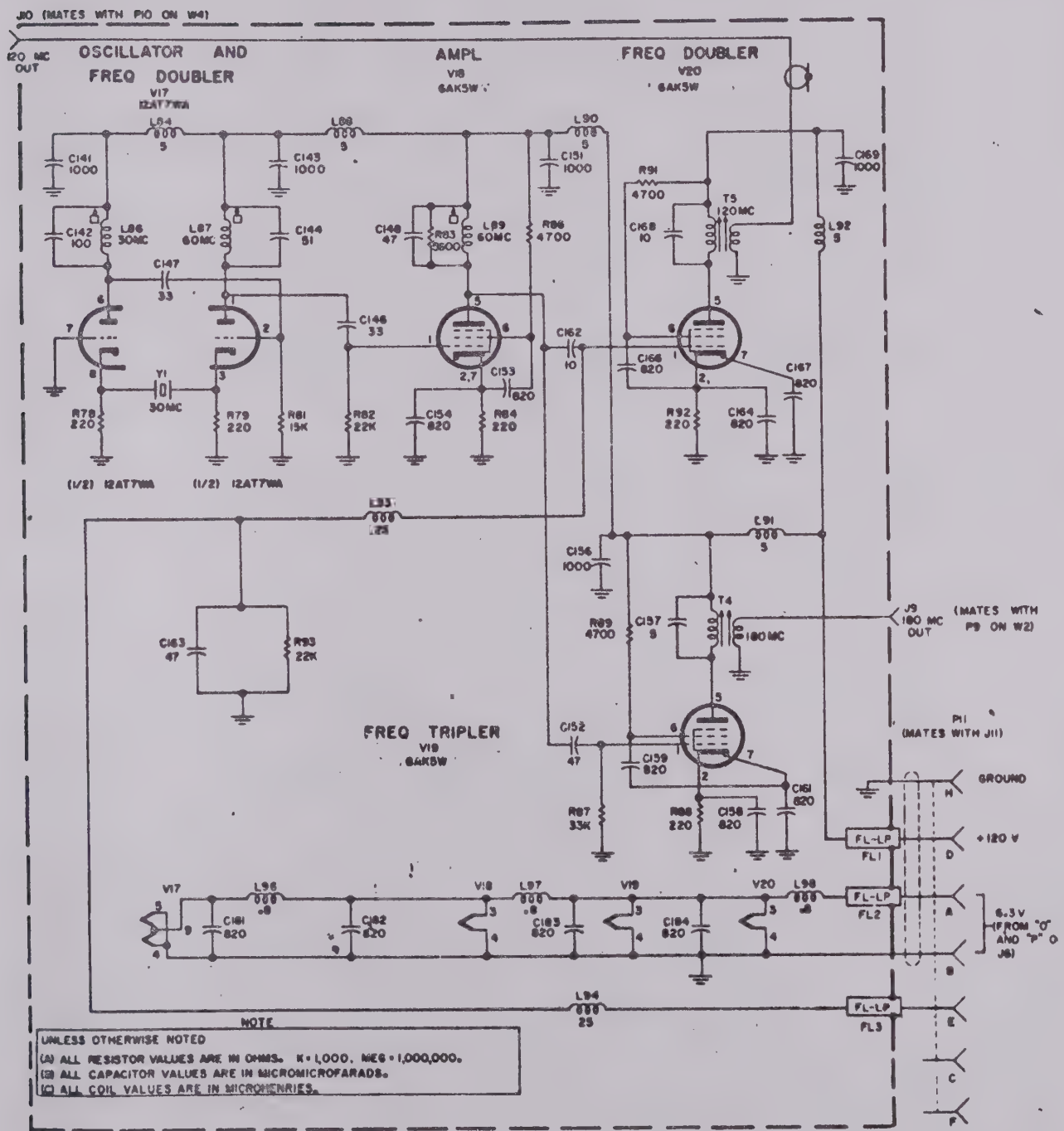


Figure 2-7. Crystal Controlled Local Oscillator, Schematic Diagram

III. 140-40MC IF AMPLIFIER: (Refer to figures 3-1 through 3-3.)

A signal generator, having a calibrated output and covering the 37- to 145-mc frequency range, such as a Measurements Corp. Model 80, is required to align the 140-40 mc i-f amplifier circuit.

To align the 40-mc stages, proceed as follows:

a. Rotate the I.F. GAIN control fully clockwise.

b. Short out the agc by connecting a ground lead between TP2 and ground, on the i-f amplifier chassis.

c. Short out the scale tracking circuit by connecting a clip lead from TP3 to ground.

d. Rotate the OUTPUT METER function selector switch to the AVERAGE position.

e. Disconnect coaxial plug P5 from its mating receptacle J5.

f. Connect a 10,000-ohm resistive load from J5 to chassis ground.

g. Connect a d-c vtvm between TP1 and chassis ground.

h. Feed a 40-mc signal from the signal generator into J2.

i. Adjust the following tuning coils for maximum indication on the vtvm, in the following sequence:

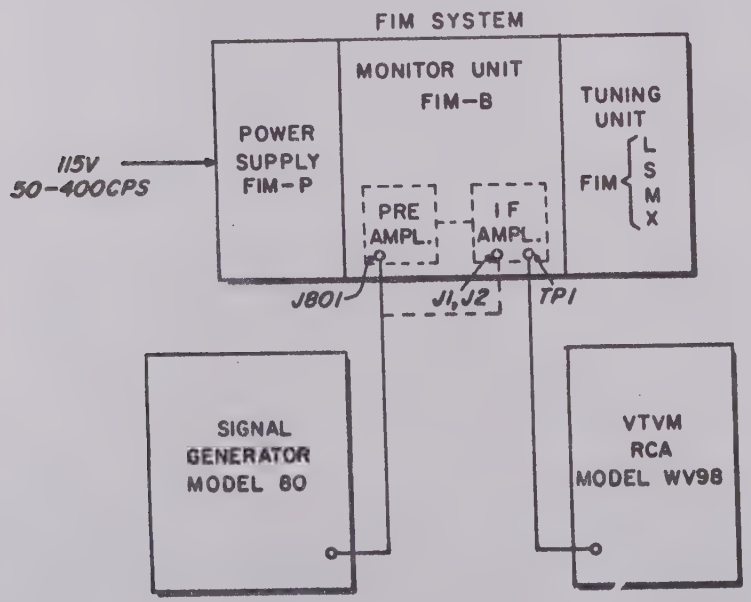


Figure 3-1. Test Setup, I-F Amplifier and Preamplifier Alignment

Sequence	Signal Generator Setting	Tuned Circuit to be adjusted
1st	40.0 mc	T2
2nd	37.5 mc	L33
3rd	42.6 mc	L27
4th	37.7 mc	L23
5th	42.3 mc	L18

j. After satisfactory peaking indications have been obtained, apply a 180-mc signal by connecting coaxial plug P2 to J2.

k. To accurately align the 140-mc stages, proceed as directed in the following steps:

1. Disconnect coaxial plug P1 from J1.
2. Connect the signal generator, set for 140 mc, through a suitable attenuator to J1.
3. Adjust T1 and L13 for a maximum indication on the vtvm.
4. Detune L4 and L8 by retracting the slug of L4 as far as possible, and inserting the slug of L8 as far as possible into the coil form.
5. Locate the center frequency, at the center of the 6-db points. For explanation purposes, assume the center frequency to be 139.8 mc.
6. Retune L13 for a maximum output indication.
7. Adjust L8 for the center frequency response, minus 3 mc. Referring back to step 5, the center frequency would now be 136.8 mc.
8. Adjust L4 for the center frequency response plus 3 mc. Again, in the example in step 5, the frequency would be 142.8 mc.

l. To check the bandwidth of the i-f amplifier circuit, proceed as follows:

1. At the 3-db points, a bandwidth of approximately 4.5 mc indicates satisfactory equipment performance.
2. At the 6-db points, a bandwidth of approximately 5.4 mc indicates satisfactory equipment operation.
3. The overall sensitivity for a signal equal to twice noise is 4 microvolts, where the noise level is 1.5 volts (at maximum gain).

m. To improve the bandwidth characteristics of the i-f amplifier, proceed as follows:

A sweep generator, producing an output at 140 mc with a ±5 mc deviation, can be used to improve the response curve slightly. In addition, an oscilloscope, having facilities for accepting an external sweep signal, must be used.

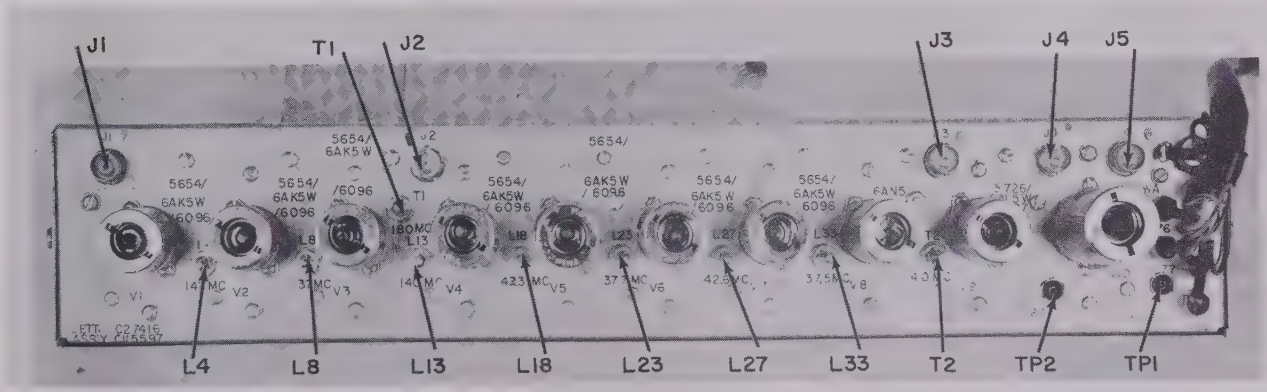


Figure 3-2. 140-40 MC Amplifier

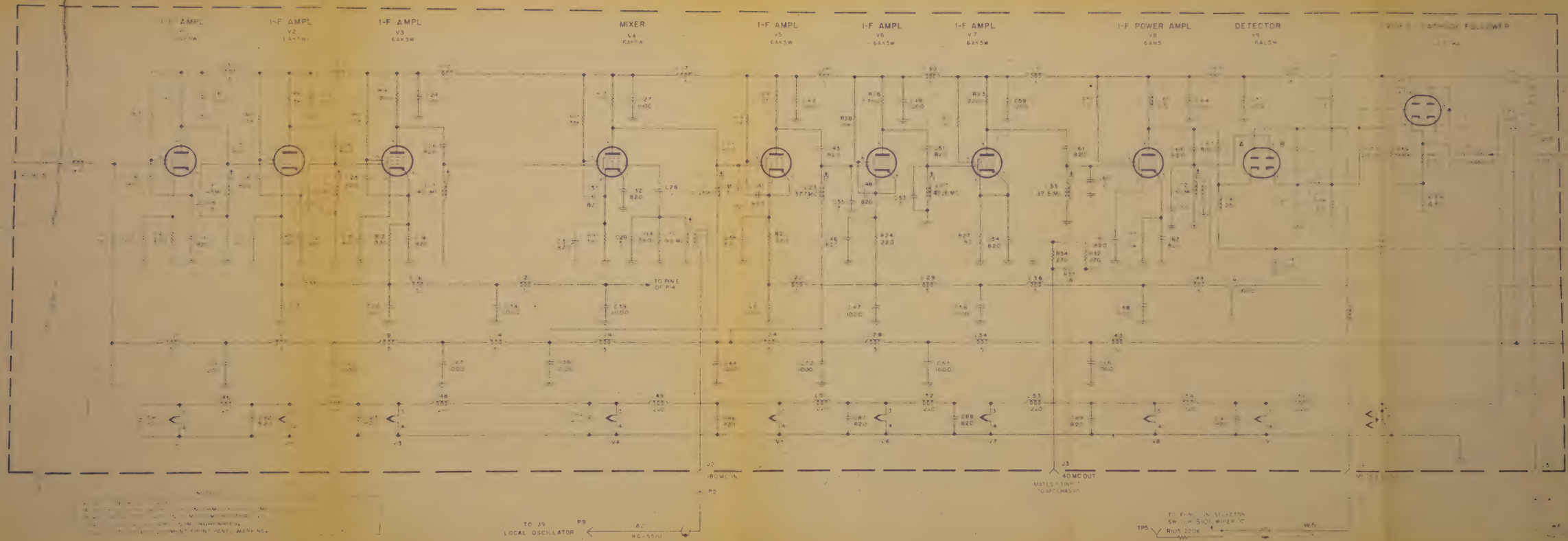


FIGURE 3-3. 140MC/40MC IF AMPLIFIER, SCHEMATIC DIAGR.

IV. PREAMPLIFIER ALIGNMENT PROCEDURE: (See figures 3-1, 4-1, and 4-2.)

Use a signal generator such as the Measurements Corp. Model 80, which is capable of producing signals from 250 to 270 mc at an output level of up to 0.1 volt. To align the preamplifier circuit, proceed as follows:

a. Connect a d-c vacuum tube voltmeter to TP1, on the i-f amplifier chassis, to observe the output voltage during the alignment procedure.

b. Set up the Monitor Unit front panel controls for normal operation. The OUTPUT METER function switch should be in the AVERAGE position.

c. Short out TP2 and TP3 by connecting a jumper between the test points and ground. (TP2 is located on the i-f amplifier chassis.)

d. Connect the output of the signal generator to preamplifier input jack J801.

e. Tune the signal generator to produce an output signal of 260 mc.

f. Adjust the I.F. GAIN control, on the Monitor Unit front panel, to mid-position. This control setting determines the noise level of the i-f amplifier.

g. Adjust T802, T801, and L801, on the preamplifier chassis, to obtain a maximum indication on the vtvm. Reduce the output level of the signal generator, if necessary, to keep the meter pointer within the 10-volt scale.

h. Remove the short from TP2.

i. Measure the bandwidth of the preamplifier by tuning the signal generator to either side of 260 mc. A bandwidth measurement of 4.5 mc to 5 mc, at the 6-db points, and a sensitivity of 3 microvolts or better at the signal equal to 1.4 times noise, indicates satisfactory equipment performance.

j. Measure the noise level by rotating the I.F. GAIN control, on the Monitor Unit front panel, to its full clockwise position. An indication that is equal to or greater than 1.0 volt is satisfactory.

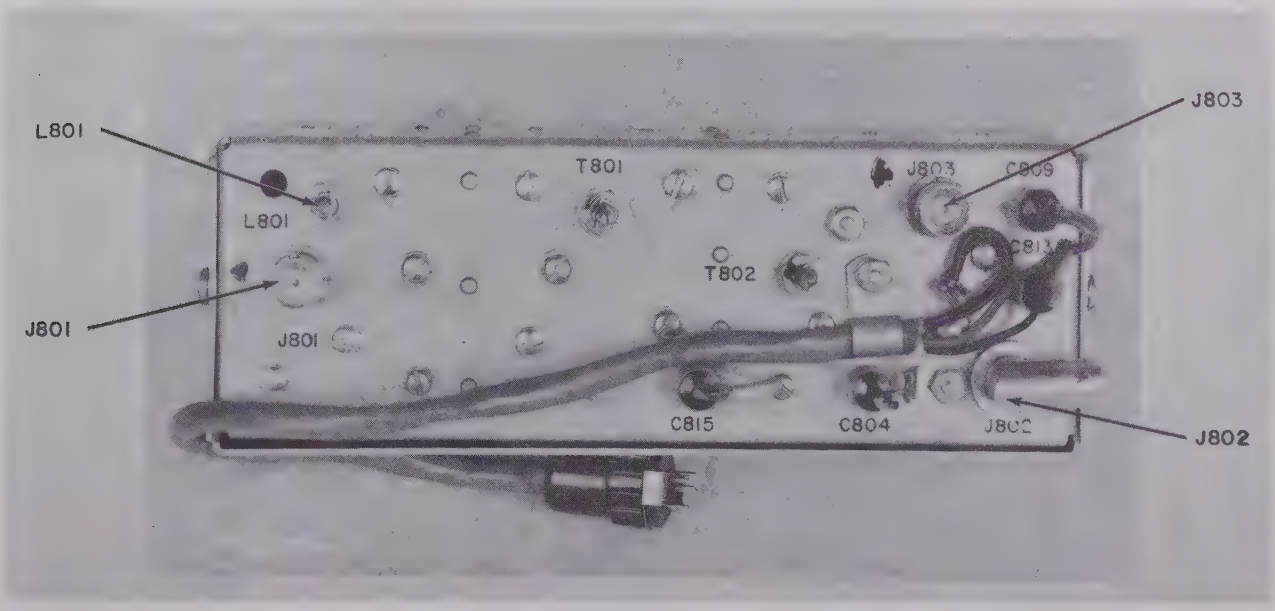


Figure 4-1. Preamplifier Chassis

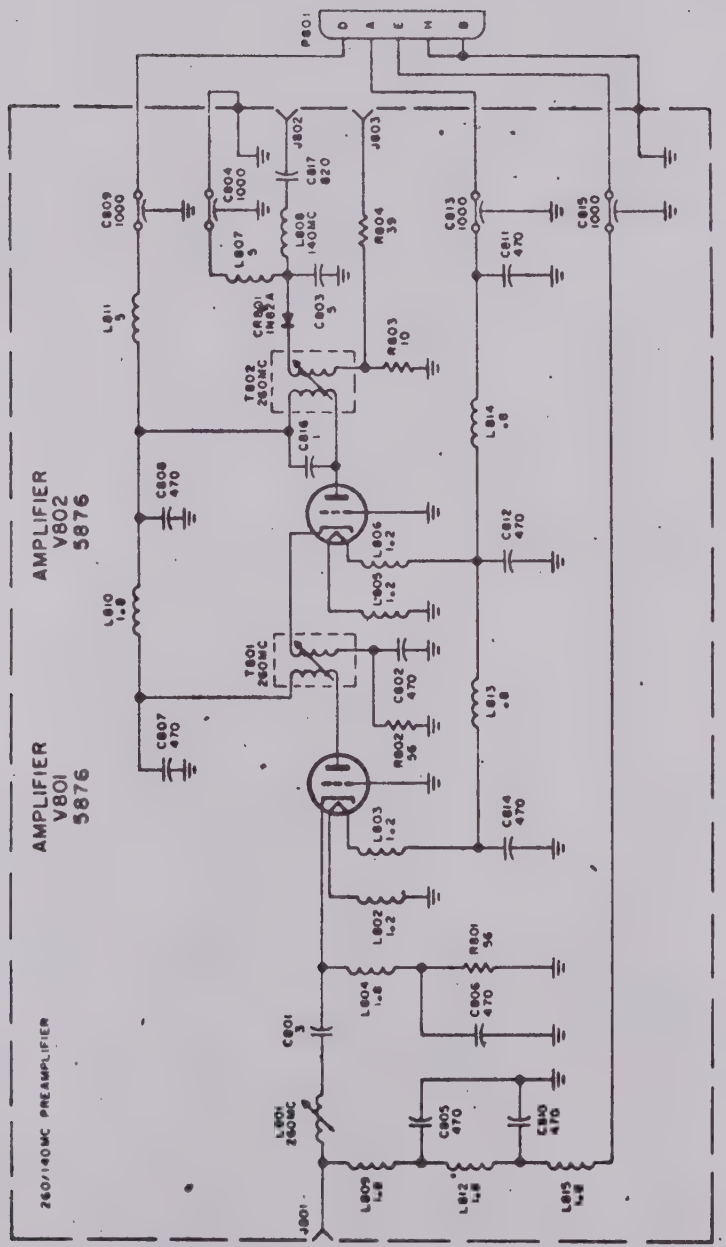


Figure 4-2. Preamplifier, Schematic Diagram

k. After satisfactory performance has been checked, as outlined in steps i and j above, disconnect the signal generator from the input to the preamplifier and disconnect the vtvm from test point TP1.

l. Reconnect the coaxial cable which feeds the output of the Tuning Unit crystal mixer to preamplifier input jack J801.

m. Rotate the function selector switch to the CAL. SIG. GEN. position.

n. After zero-setting the POWER MONITOR meter and the OUTPUT METER, apply a strong signal to the preamplifier, using the internal signal calibrator of the equipment. Adjust the level of the applied signal to obtain a meter reading less than maximum.

o. Rotate the OUTPUT METER function selector switch to the AVERAGE position.

p. Retune the tuning slug of variable inductor L801, to obtain maximum pointer deflection on the OUTPUT METER.

V. AFC CIRCUIT ALIGNMENT: (See figures 5-1 and 5-2.)

WARNING

DISCONNECT P7 FROM J7 TO REMOVE THE REFLECTOR VOLTAGE FROM THE DISCRIMINATOR CIRCUIT.

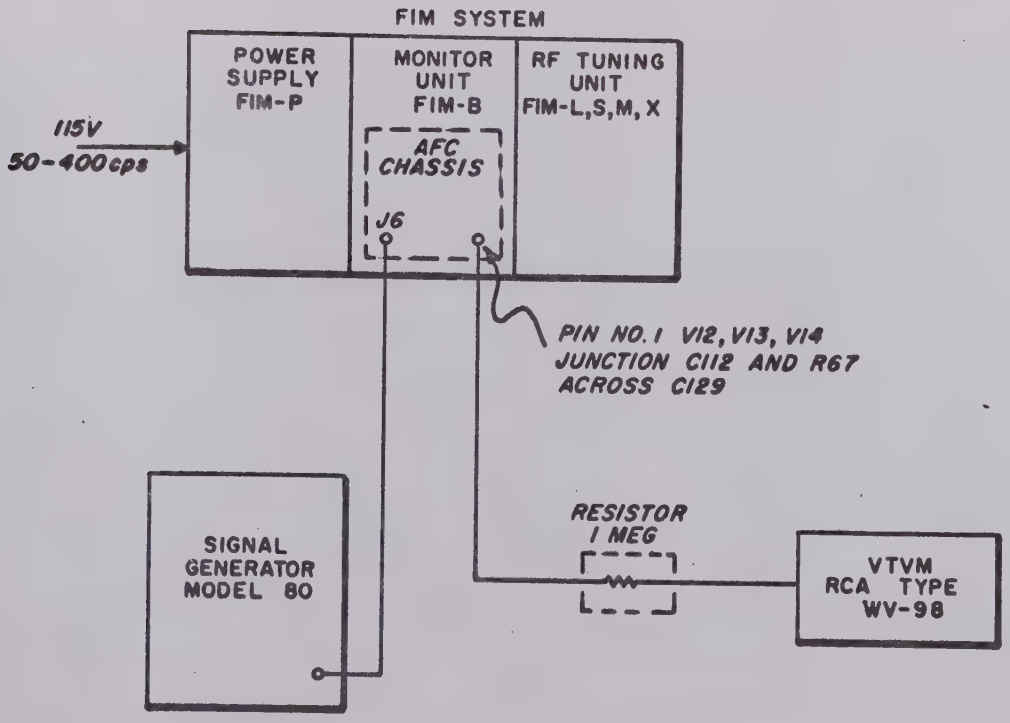


Figure 5-1. Test Set-Up, AFC Alignment

ADJUSTMENT AND ALIGNMENT PROCEDURES FOR

THE MODEL FIM MICROWAVE FIELD INTENSITY METER

A signal generator covering the frequency range from 35 to 45 mc and a d-c vtvm with a high value resistance (such as 1 megohm) connected in series with the test probe, are required for performing the alignment procedure. To align the afc circuit, proceed as follows:

a. Connect a signal generator, set for 40 mc and an output of 50,000 microvolts, to J6.

b. Connect a vtvm, set for negative dc, through a 1-megohm resistor, between pin 1 of V12 and ground.

c. Tune L57 for a maximum indication on the vtvm.

d. Reconnect the vtvm to pin 1 of V13 and adjust L59 for a maximum reading on the vtvm.

e. Reconnect the vtvm to pin 1 of V14 and adjust L62 for a maximum reading on the vtvm.

f. Reconnect the vtvm to the junction of C112 and R67, reducing the signal-generator output to produce a 0.5-volt indication on the vtvm.

g. Adjust L64 for a maximum indication on the vtvm.

h. Increase the signal-generator output to 50,000 microvolts.

i. Rotate NOISE BALANCE control R76 to its midrange.

j. Set the vtvm to the 15-volt scale and zero adjust the meter so that "0" volts is center scale.

k. Connect the vtvm across C129.

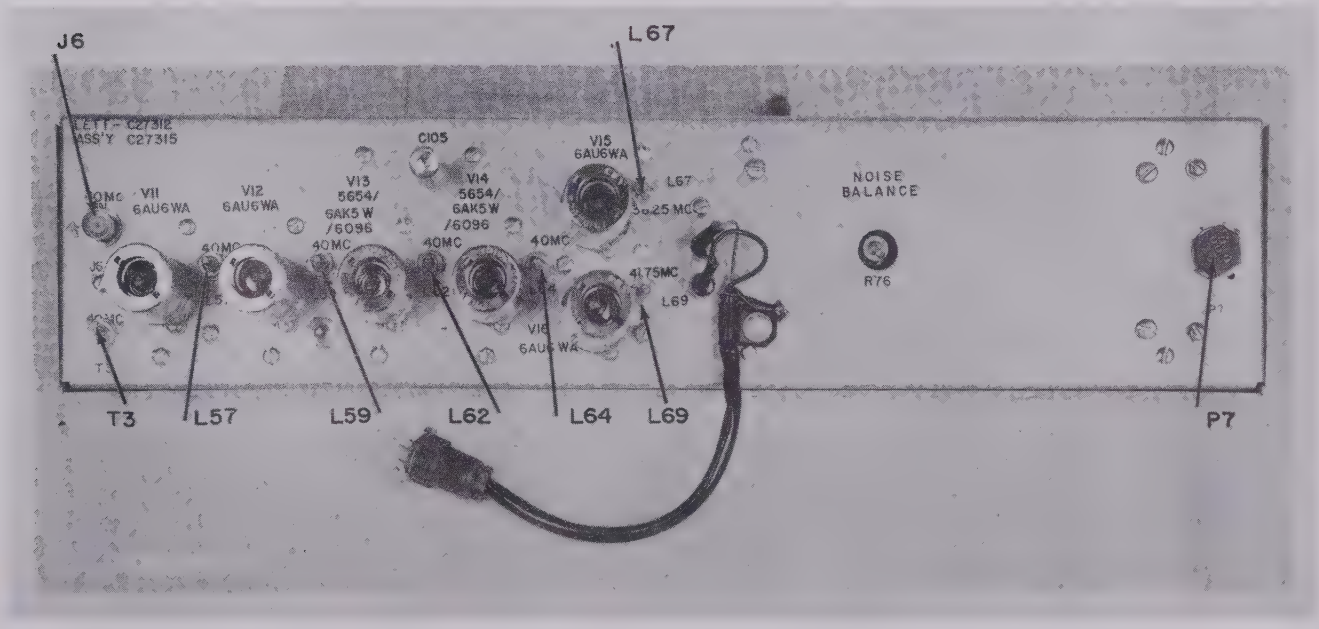


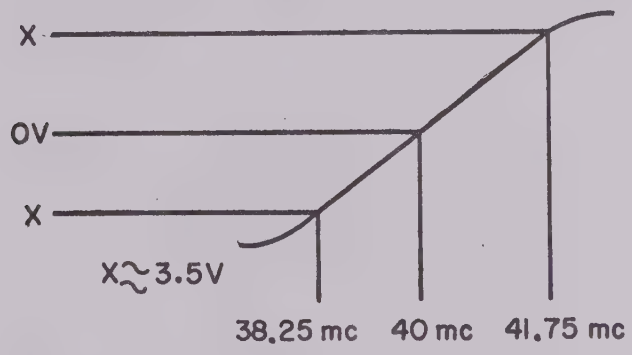
Figure 5-2. AFC Assembly, Top View of Chassis

l. Feed a 38.25-mc signal from the signal generator into J6, and adjust L67 for a maximum deflection on the vtvm.

m. Reset the signal generator to 41.75 mc and adjust L69 for a maximum deflection on the vtvm.

n. Reset the signal generator to 40 mc and adjust NOISE BALANCE potentiometer R76 so that at 40 mc the vtvm pointer indicates "0" at center scale.

o. Vary the signal-generator frequency from 38.25 to 41.75 mc. The range of indicated values should correspond to the diagram below:



NOTE

0 volts should fall at the 40-mc mark and the "X" values should be approximately equal at 38.25 mc and 41.75 mc. If the above results cannot be obtained, V15, V16, or CR1 and CR2 should be replaced and the complete discriminator alignment procedure should be repeated.

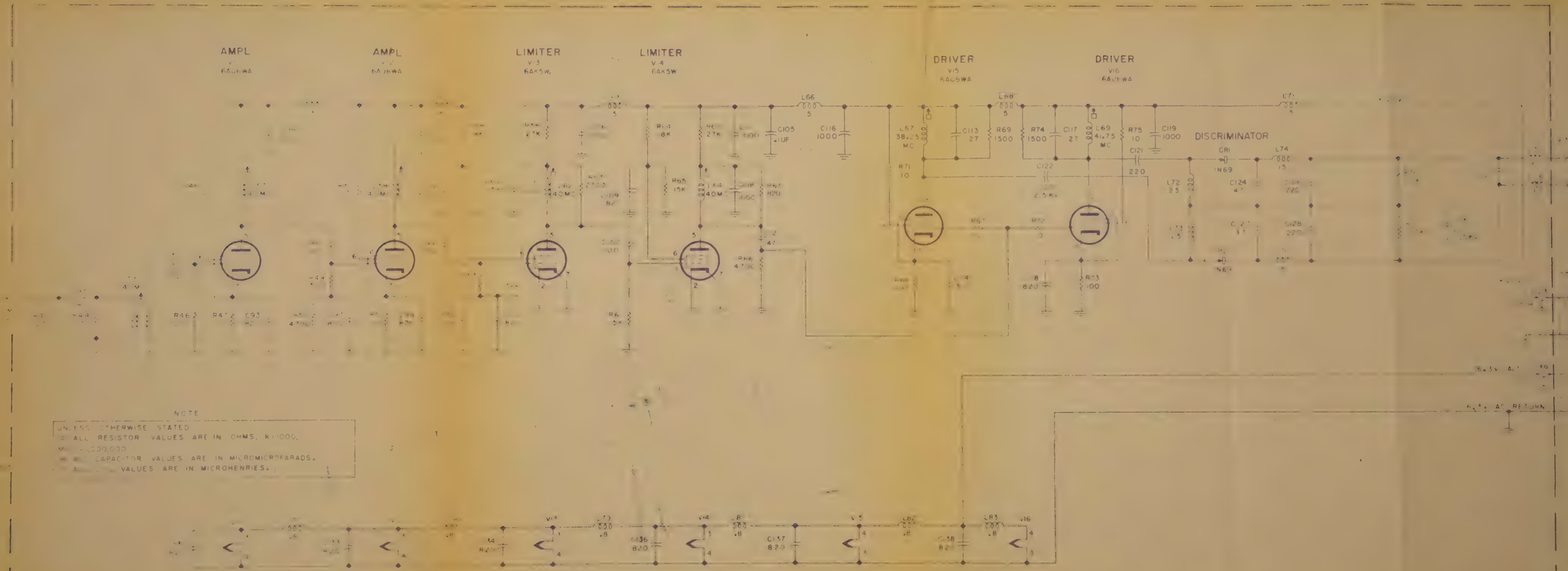


FIGURE 5-3. AMPLIFIER, SCHEMATIC DIAGRAM.

VI. COMPLETING I-F ALIGNMENT: (See figure 5-3.)

After the alignment of the individual chassis has been completed, it will be necessary to touch up certain adjustments, because of impedance of interconnecting cables. To accomplish this, proceed as follows:

a. Connect all interconnecting cables.

b. Connect a signal generator, set to 260 mc, to preamplifier input jack J801.

c. Short out TP2 and connect a vtvm to TP1.

d. Adjust T802, on the preamplifier chassis, for a maximum indication on the vtvm.

e. Adjust T5, on the local-oscillator chassis, for a maximum indication.

f. Repeat steps d and e, as necessary, until a peak indication is noted on the vtvm.

g. Reconnect the signal generator, set for 140 mc, to the 140 MC IN jack on the equipment front panel.

h. Adjust T1 on the i-f amplifier chassis and T4 on the local-oscillator chassis for maximum indications.

i. Repeat the adjustments of step h, as necessary, until a peak reading is indicated on the vtvm.

j. Reconnect the vtvm to TP6, on the afc chassis.

k. Adjust T3, on the afc chassis, for a maximum reading on the vtvm.

l. Adjust T2, on the i-f chassis, for a maximum indication on the vtvm.

VII. MONITOR SCALE ADJUSTMENTS, SERIAL NUMBERS 101-130 ONLY: (See figure 7-1.)

a. To adjust the AVERAGE position of the OUTPUT METER, function selector switch, proceed as follows:

1. Rotate the OUTPUT METER function selector switch to the ZERO SET position.

2. Disconnect cables from jacks J1 and J2, on the i-f amplifier chassis.

3. Ground test point TP2, on the i-f amplifier chassis.

4. Connect a 20,000 ohm-per-volt d-c voltmeter to test point TP4 on the audio, video, and metering chassis, and vary the setting of F.I. LOW SET potentiometer R135 to obtain an indication of 0.75 volt on the meter.

5. Lock the shaft of R135 to secure the setting of the F.I. LOW SET potentiometer.

6. Remove the voltmeter from test point TP4, and connect the voltmeter to test point TP3 on the audio, video, and metering circuits chassis.

7. Rotate SCALE TRACKING potentiometer R144 fully counterclockwise to obtain the minimum voltmeter indication.

8. Reconnect the 180-mc signal from the crystal-controlled local oscillator to the i-f amplifier by mating coaxial connector P2 to receptacle J2, on the i-f amplifier chassis.

9. Connect the output of a signal generator, producing a signal frequency of 140 mc, to jack J1, at the input to the i-f amplifier.

10. Connect a vtvm to test point TP1, on the i-f amplifier, and adjust the I.F. GAIN control on the Monitor Unit front panel to obtain a noise indication of 1.0 volt on the vtvm.

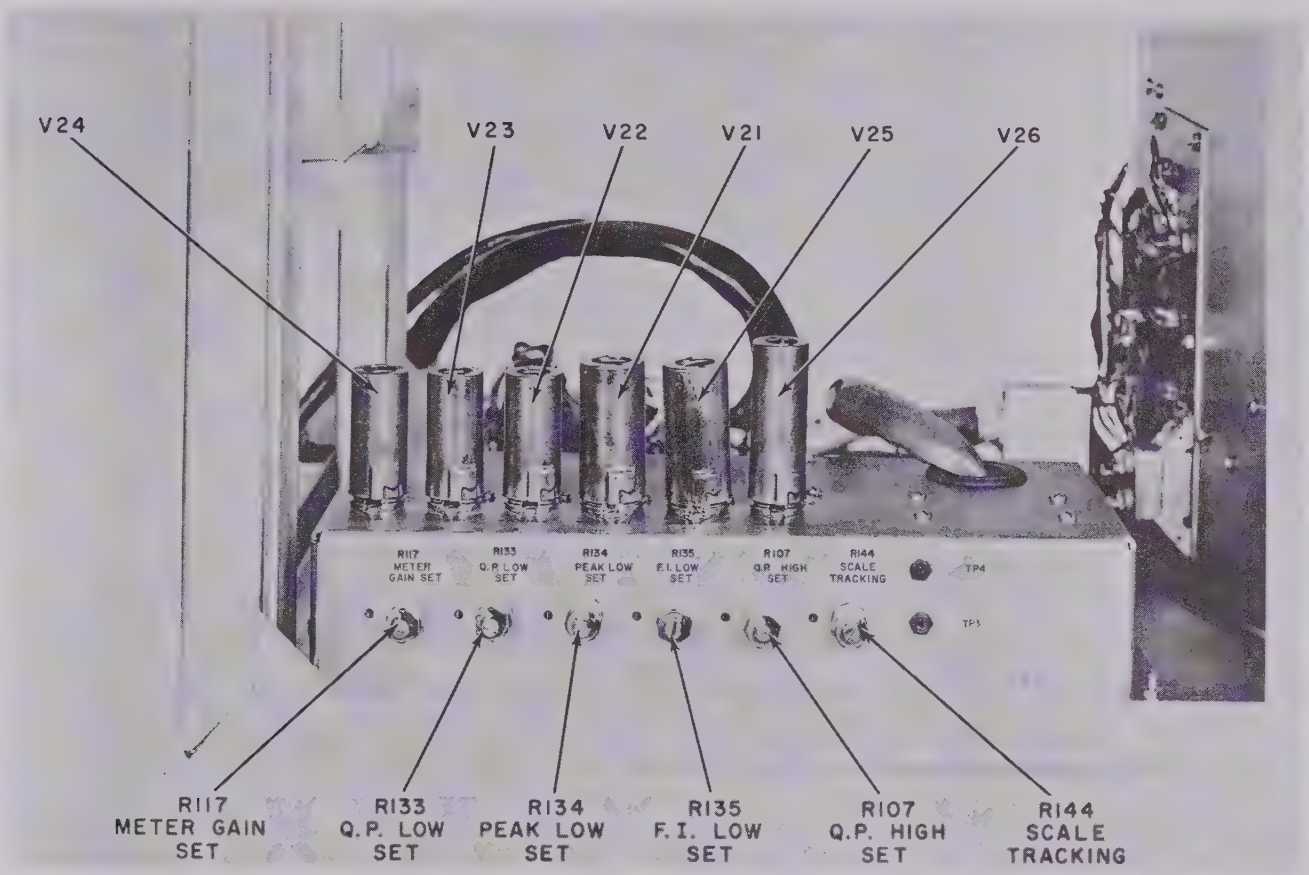


Figure 7-1. Audio, Video, and Metering Circuits Chassis, Top View

11. Increase the output of the signal generator to obtain an indication of 1.41 volts on the vtvm.

12. Record this signal-generator output as S MINIMUM, which represents the minimum signal. (See the agc meter tracking curves in figure 7-2.)

13. With the d-c voltmeter still connected to test point TP3 on the audio, video, and metering chassis, vary the setting of SCALE TRACKING potentiometer R144 to obtain a 1.0-volt indication on the voltmeter.

14. Remove the ground connection from test point TP2, on the i-f amplifier chassis.

15. With the signal-generator output level still set at S MINIMUM (step 12, above), connect the vtvm to test point TP5.

16. Vary the front panel I.F. GAIN control to obtain an indication of 0.60 volt on the vtvm.

17. Rotate METER GAIN SET potentiometer R117, on the audio, video, and metering chassis, fully counterclockwise.

18. Increase the output of the signal generator to S MINIMUM plus 40 db (which is 100 times S MINIMUM in terms of voltage).

19. Adjust the OUTPUT METER ZERO SET control to obtain a pointer deflection at the extreme left hand scale mark on the OUTPUT METER.

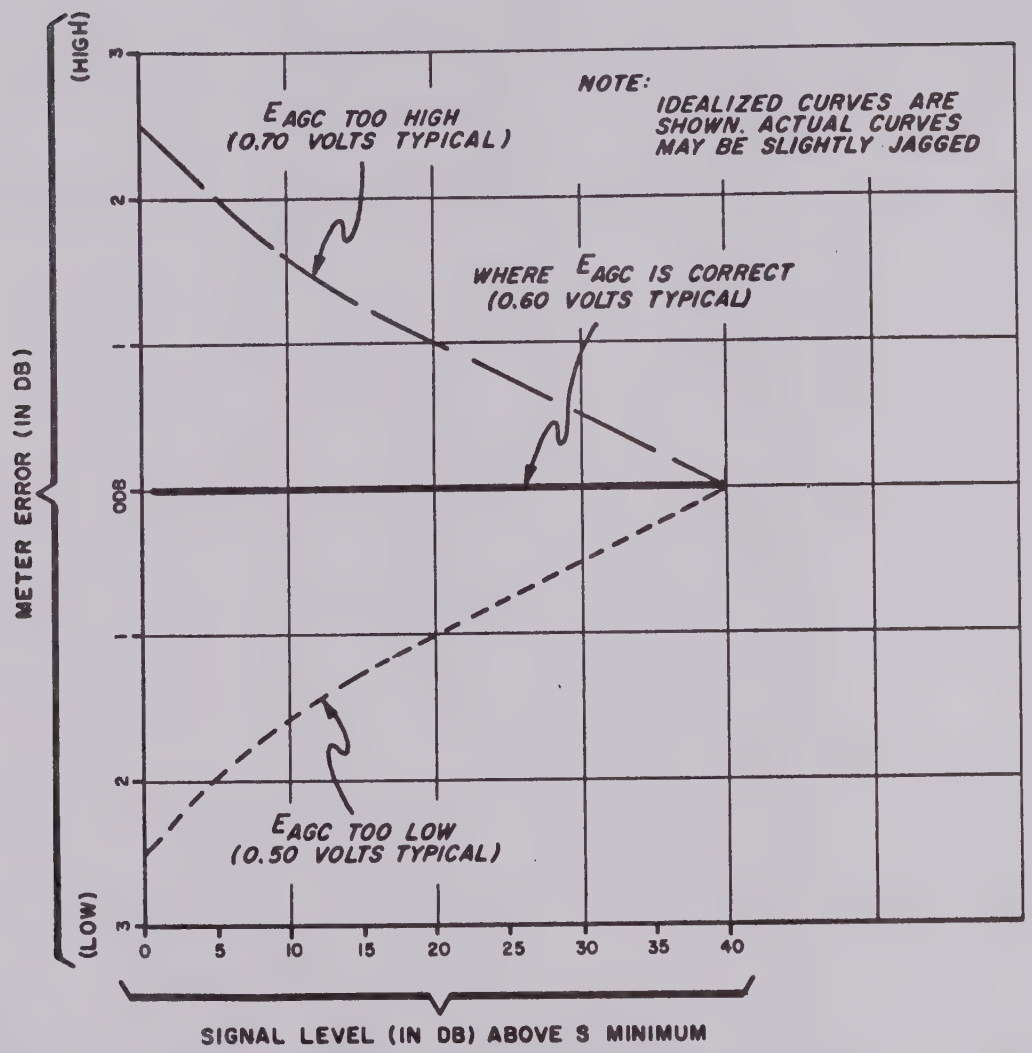


Figure 7-2. Agc Meter Tracking Curves

20. Rotate the OUTPUT METER function selector switch to the AVERAGE position.

21. Adjust METER GAIN SET potentiometer R117 until the OUTPUT METER pointer deflects full scale.

22. Rotate the OUTPUT METER function selector switch to ZERO SET.

23. Repeat steps 19 through 21 as many times as necessary in order to eliminate interaction.

24. Plot a curve of Meter Error vs Signal Level, as shown in figure 7-2.

25. If the curve is above the 0 db error line, reduce E_{AGC} (step 15) by reducing the setting of the I.F. GAIN control slightly. If the curve is below the 0 db error line, increase E_{AGC} by rotating the I.F. GAIN control a few degrees clockwise.

NOTE

The correct value of E_{AGC} in step 15 is very critical. A value ±0.1 volt away from the correct value will result in meter indication errors of as much as 1 db at midscale, and 3 db at the low end of the scale.

26. The correct value of E_{AGC} to use in step 15 is that value which results in the minimum meter indication error over the range from S MINIMUM to 40 db above S MINIMUM.

27. Disconnect the signal generator, and reconnect the preamplifier, using the interconnecting cables.

28. Rotate the I.F. GAIN control to maximum. A meter indication of a 30-db noise minimum should be present. If this indication is not present, it is necessary to repeat the entire procedure, except to change step 13 by reducing the setting of R144 to 0.5 volt. If the 30-db noise minimum is still not present, reduce the setting of R144 still further.

b. To adjust the QUASI-PEAK position of the OUTPUT METER function selector switch, perform the following adjustments: (Before proceeding with the following adjustments, the output meter tracking circuit must have been correctly tracked for the AVERAGE position of the OUTPUT METER function selector switch, as outlined in the preceding paragraphs. In addition, the I.F. GAIN control on the Monitor Unit front panel must be set as finally determined for the acceptable meter tracking curve error, as shown in figure 7-2.)

1. Rotate the OUTPUT METER function selector switch to the ZERO SET position.

2. Adjust the OUTPUT METER ZERO SET control to obtain a pointer deflection on the OUTPUT METER to the extreme left-hand scale mark.

3. Connect the output of the signal generator, which is producing a signal frequency of 140 mc, to jack J1, at the input to the 140-40mc i-f amplifier. Set the output of the signal generator for S MINIMUM.

4. Rotate the OUTPUT METER function selector switch to the QUASI-PEAK position.

5. Adjust Q.P. LOW SET potentiometer R133 on the audio, video, and metering chassis to obtain a meter pointer deflection to the 20-db mark on the meter's red decibel scale.

6. Increase the signal-generator output to produce a level of S MINIMUM plus 40 db (S MINIMUM x 100).

7. Adjust Q.P. HIGH SET potentiometer R107 on the audio, video and metering chassis to obtain a meter pointer deflection to the 60-db mark on the meter's red decibel scale.

8. Repeat steps 5 through 7, above, several times to eliminate interaction between the two control settings.

c. To adjust the PEAK position of the OUTPUT METER function selector switch, perform the following adjustments: (Before proceeding with the following adjustments, the OUTPUT METER must have been correctly tracked for the AVERAGE and the QUASI-PEAK positions of the switch, as outlined in paragraphs 7a and 7b.)

1. Connect the preamplifier output cable (140 mc) to J1, at the input to the 140-40mc i-f amplifier.

2. Select any Tuning Unit and use a microwave signal generator of the appropriate frequency range. The signal generator should have provision for pulse modulation.

3. Zero set the OUTPUT METER.

4. Rotate the appropriate function selector switch to the USE position, and set the output control of the signal generator to a c-w level of 1,000 microvolts.

5. Rotate the OUTPUT METER function selector switch to the AVERAGE position. With the receiver exactly tuned to the incoming signal, adjust the I.F. GAIN control for a deflection on the OUTPUT METER of 1,000 microvolts (or 60 db on the red db scale).

6. Switch the signal generator to produce square-wave modulation, at some audio rate. If square-wave modulation is unobtainable on the signal generator, a duty cycle of one percent or greater can be used.

7. Slight retuning of the Model FIM may be necessary. This can be done with the OUTPUT METER function selector switch in the QUASI-PEAK position.

8. Plug a 600-ohm headset into the AUDIO OUT jack, on the Monitor Unit front panel.

9. Rotate the OUTPUT METER function selector switch to its PEAK position.

10. Rotate the SLIDEBACK control fully counterclockwise.

11. Adjust the AUDIO GAIN control for a comfortable listening level.

12. Rotate the SLIDEBACK control clockwise to full-scale pointer deflection.

13. Adjust PEAK LOW SET potentiometer R134 until the sound intensity in the headset sharply decreases; meanwhile, maintain a full-scale pointer deflection (1000 microvolts) on the OUTPUT METER by simultaneously readjusting the SLIDEBACK control.

14. With the PEAK LOW SET potentiometer properly adjusted, the sound intensity in the headset should sharply decrease when the meter indicates 1000 microvolts, while the SLIDEBACK control is rotated in a clockwise direction.

15. Reset the output level of the signal generator to produce 100 microvolts (a decrease of 20 db).

16. When rotating the SLIDEBACK control in a clockwise direction, the sound intensity in the headset should decrease sharply when the OUTPUT METER indicates 100 microvolts (or 40 db on the red db scale). If this indication is off by more than one db, the PEAK LOW SET control should be reset at this 100-microvolt level; meanwhile, maintain a 100-microvolt indication on the OUTPUT METER by readjusting the SLIDEBACK control.

17. Satisfactory equipment performance is indicated when the tracking error in the PEAK position of the OUTPUT METER function selector switch is less than one db between OUTPUT METER readings of 25 db to 60 db. If this indication is not obtained, repeat the adjustments outlined in steps 6 through 16 above, to compensate for the tracking error observed.

VIII. MONITOR SCALE ADJUSTMENTS, SERIAL NUMBERS 131 AND HIGHER: (See figures 7-1 and 8-1.)

a. To adjust the AVERAGE position of the OUTPUT METER function selector switch, proceed as follows:

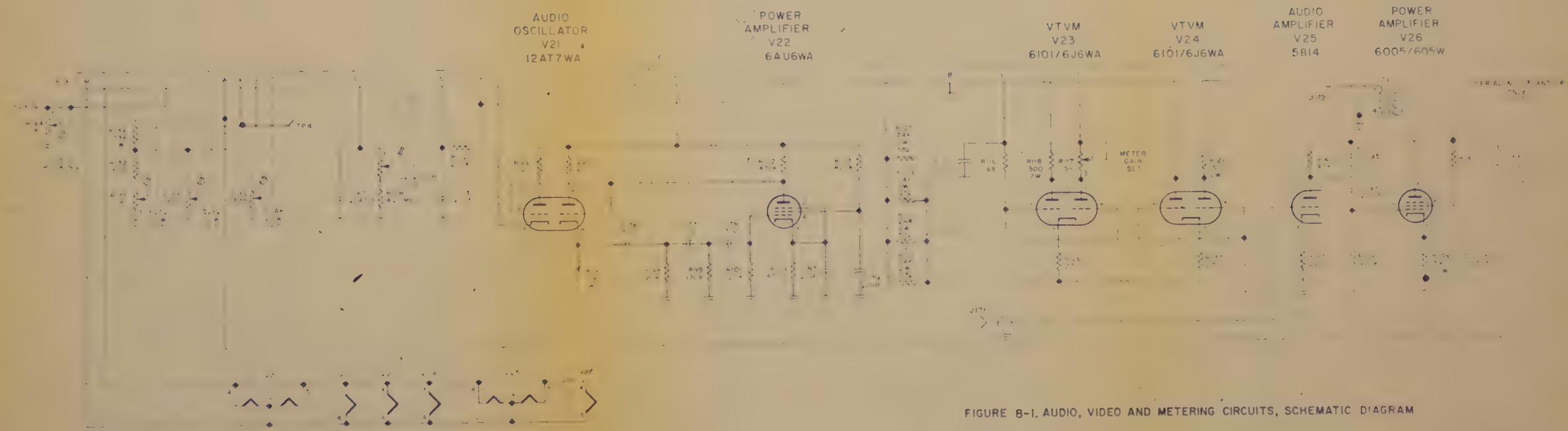


FIGURE 8-1. AUDIO, VIDEO AND METERING CIRCUITS, SCHEMATIC DIAGRAM

ADJUSTMENT AND ALIGNMENT PROCEDURES FOR

THE MODEL FIM MICROWAVE FIELD INTENSITY METER

1. Rotate the OUTPUT METER function selector switch to ZERO SET position.

2. Disconnect cables from jacks J1 and J2, on the i-f amplifier chassis.

3. Connect a vtvm between the center tap of R194 and ground, and adjust R194 for maximum negative voltage (apprximately -7 volts dc).

4. Connect a 20,000 ohm-per-volt d-c voltmeter to test point TP4, and vary the setting of F.I. LOW SET potentiometer R135 to obtain an indication of 0.75 volt on the meter. Lock the shaft of R135 to secure this setting.

5. Connect the output of a signal generator, producing a signal of 140 mc at 4 microvolts, such as Measurements Corp. Model 80, at the input to the i-f amplifier (J1).

6. Remove the d-c voltmeter from TP4, and connect the voltmeter to test point TP3 on the audio, video, and metering chassis. Adjust the setting of SCALE TRACKING potentiometer R144 to obtain a 1-volt reading on the voltmeter.

7. Adjust the I.F. GAIN control for a 10-microvolt reading on the OUTPUT METER.

8. Increase the output of the signal generator to 400 microvolts.

9. Rotate METER GAIN SET potentiometer R117 until the OUTPUT METER pointer deflects full scale.

10. Repeat steps 5 through 9 as many times as necessary to eliminate interaction. Disconnect the signal generator.

11. Connect the preamplifier output to the i-f amplifier.

12. Rotate the I.F. GAIN control to the maximum position.

13. Adjust SCALE TRACKING potentiometer R144 until the pointer on the OUTPUT METER is deflected to at least 30 microvolts.

14. Disconnect the preamplifier, and connect the signal generator to the 140-mc i-f input.

15. Repeat steps 5 through 9, except DO NOT ADJUST R144 (step 6).

16. Plot a curve of Meter Error vs. Signal Level at 5-db increments. A typical curve is shown in figure 8-2.

NOTE

If there is no error of more than 1/2 db along the scale, mid-scale potentiometer R194 (figure 8-3) need not be adjusted. It is recommended that alignment accuracy be rechecked several times before adjustment of R194.

17. If there is an error of more than 1/2 db along the scale, proceed as follows:

(a) Adjust R194 until the vtvm reads -4 volts dc.
(b) Repeat previous tracking alignment (step 16).
(c) If the error is still greater than 1/2 db, adjust R194 for a reading of -3.5 volts on the vtvm.
(d) Repeat tracking alignment.
(e) Continue to decrease the setting of R194 by 0.5-volt increments, until the error is less than 1/2 db. (For the average i-f strip, R194 need not be adjusted for less than -2.5 volts.)

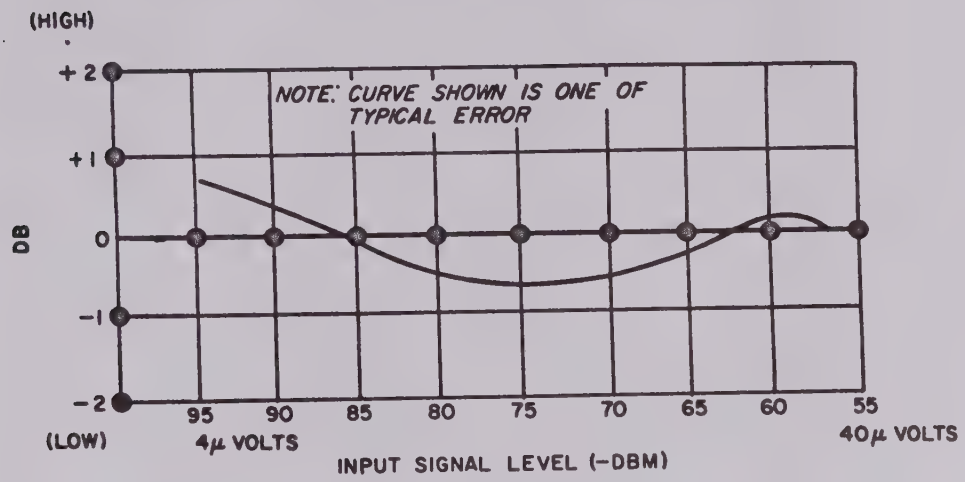


Figure 8-2. Meter Tracking Curve

b. To adjust the QUASI-PEAK position of the OUTPUT METER function selector switch, perform the following adjustments: (Before proceeding with the following adjustments, the output meter tracking circuit must have been correctly tracked for the AVERAGE position of the OUTPUT METER function selector switch, as outlined in the preceding paragraphs. In addition, the I.F. GAIN control on the Monitor Unit front panel must be set as finally determined for the acceptable meter tracking curve error, as shown in figure 8-2.)

1. Rotate the OUTPUT METER function selector switch to the ZERO SET position.

2. Connect a vtvm between the center tap of R193 and ground, and adjust R193 for the same voltage as obtained in step 17 of paragraph 8a, above.

3. Adjust the OUTPUT METER ZERO SET control to obtain a pointer deflection on the OUTPUT METER to the extreme left-hand scale mark.

4. Connect the output of the signal generator, producing a signal of 140 mc at 4 microvolts, at the input to the i-f amplifier (J1).

5. Rotate the OUTPUT METER function selector switch to the QUASI-PEAK position.

6. Adjust Q.P. LOW SET potentiometer R133 on the audio, video, and metering chassis (figure 7-1) to obtain a 10-microvolt reading on the OUTPUT METER.

7. Increase the output of the signal generator to 400 microvolts.

8. Adjust Q.P. HIGH SET potentiometer R107 (figure 7-1) to obtain a 1000-microvolt reading (full scale) on the OUTPUT METER. Repeat steps 4 through 8 several times to eliminate interaction between the two control settings.

9. Plot a curve of Meter Error vs. Signal Level at 5-db increments. A typical curve is shown in figure 8-2.

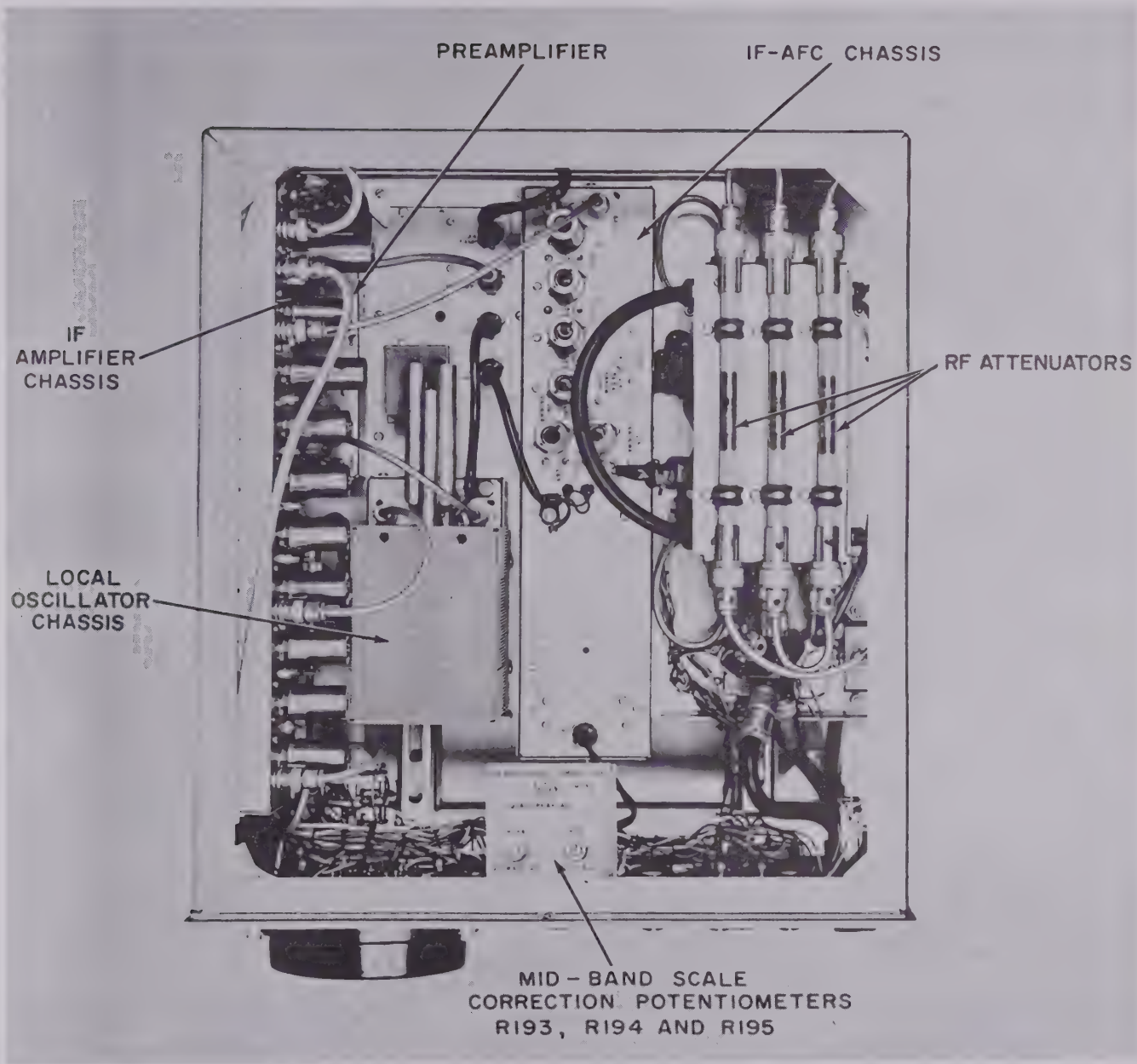


Figure 8-3. Monitor Unit, Top View Showing Location of Subchassis

10. If there is an error of more than 1/2 db along the scale, decrease the voltage of R193 by 0.5-volt increments, until the error is less than 1/2 db.

c. To adjust the PEAK position of the OUTPUT METER function selector switch, perform the following adjustments: (Before proceeding with the following adjustments, the OUTPUT METER must have been correctly tracked for the AVERAGE and the QUASI-PEAK positions of the switch, as outlined in paragraphs 8a and 8b. See figure 8-4.)

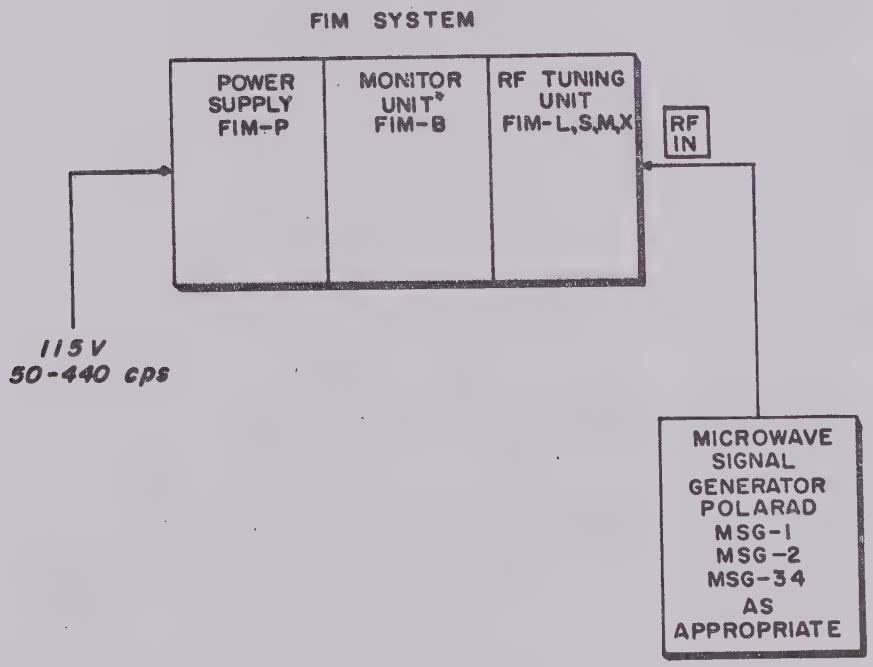


Figure 8-4. Test Setup, Peak Scale Adjustment

1. Connect the preamplifier output cable (140 mc) to J1, at the input to the 140-40mc i-f amplifier.

2. Connect a vtvm between the center tap of R195 and ground, and adjust R195 for the same voltage as was obtained in step 17 of paragraph 8a, above.

3. Select any Tuning Unit and use a microwave signal generator of the appropriate frequency range, such as Measurements Corp. Model 80. The signal generator should have provision for pulse modulation.

4. Zero set the OUTPUT METER.

5. Rotate the appropriate function selector switch to the F.I.M. position, and set the output control of the signal generator to a c-w level of 1,000 microvolts.

6. Rotate the OUTPUT METER function selector switch to the AVERAGE position. With the receiver tuned to the incoming signal, adjust the I.F. GAIN control for a deflection on the OUTPUT METER of 1,000 microvolts (or 60 db on the red db scale).

7. Switch the signal generator to produce square wave modulation, at some audio rate. If square-wave modulation is unobtainable on the signal generator, a duty cycle of one percent or greater can be used. Make sure that peak-pulse level is equal to the c-w level.

8. Slight retuning of the Model FIM may be necessary. This can be done with the OUTPUT METER function selector switch in the QUASI-PEAK position.

9. Plug a 600-ohm headset into the AUDIO OUT jack, on the Monitor Unit front panel.

10. Place the OUTPUT METER function selector switch to its PEAK position.

11. Rotate the SLIDEBACK control fully counterclockwise.

12. Adjust the AUDIO GAIN control for a confortable listening level.

13. Rotate the SLIDEBACK control clockwise to full scale pointer deflection on the OUTPUT METER.

14. Adjust PEAK LOW SET potentiometer R134 (figure 7-1) until the sound intensity in the headset sharply diminishes; meanwhile, maintain a full-scale pointer deflection on the OUTPUT METER by simultaneously readjusting the SLIDEBACK control.

15. With the PEAK LOW SET potentiometer properly adjusted, the sound intensity in the headset should sharply decrease when the meter indicates 1,000 microvolts, while the SLIDEBACK control is rotated in a clockwise direction.

16. Reset the output level of the signal generator to produce 100 microvolts (a decrease of 20 db).

17. When rotating the SLIDEBACK control in a clockwise direction, the sound intensity in the headset should decrease sharply when the OUTPUT METER indicates 100 microvolts (or 40 db on the red db scale).

18. If the reading on the OUTPUT METER is off by more than one db (step 17) decrease the setting of R195 by 0.5-volt increments, until the tracking error is less than one db.

NOTE

Each time the voltage across R195 is decreased by 0.5 volt, steps 5 through 17 have to be repeated.

19. Satisfactory equipment performance is indicated when the tracking error in the PEAK position of the OUTPUT METER function selector switch is less than one db between the OUTPUT METER readings of 25 db to 60 db, at 5-db increments.

IX. TUNING HEAD ALIGNMENT, MODEL FIM: (See figures 9-6 through 9-14.)

a. Before installation of a klystron tube, the voltage present at the klystron tube socket must be measured. The following voltages should be available at the pins of the klystron tube socket:

1. Pins 2 and 4: 6.3 volts ac, klystron filament voltage.

2. Pin 3: beam voltage

3. Pin 1: grid voltage

4. The following chart lists the anode voltages for the Bands 1 through 4 R-F Tuning Units:

Band	Beam Voltage
1	-325 vdc
2	-325 vdc
3	-1000 vdc
4	-1250 vdc

5. Varying the klystron bias potentiometers should vary the voltage between pins 3 and 1 of the klystrons. The voltage should vary smoothly from 0 to 50 volts.

6. Vary the frequency tuning control from the low end to the high end while monitoring the repeller voltage with respect to the anode. As the frequency is increased, the repeller voltage should rise smoothly. Bands 1 and 4 contain microswitches to switch modes. Reflector voltage variation for bands 1 and 4 is illustrated in figure 9-1.

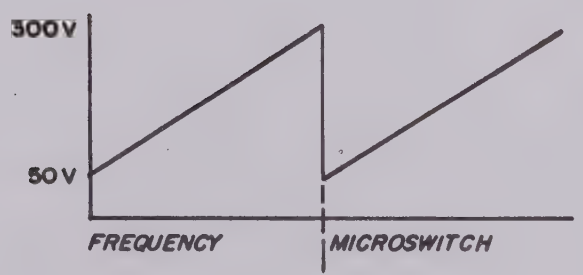


Figure 9-1. Reflector Voltage Variations for Bands 1 and 4

7. At various settings of the frequency dial (for example, the low, middle, or high ends), vary the appropriate adjustment (low potentiometer, low-mode potentiometer, high-mode potentiometer, etc.), and observe whether the reflector voltage varies smoothly. This is illustrated in figure 9-2.

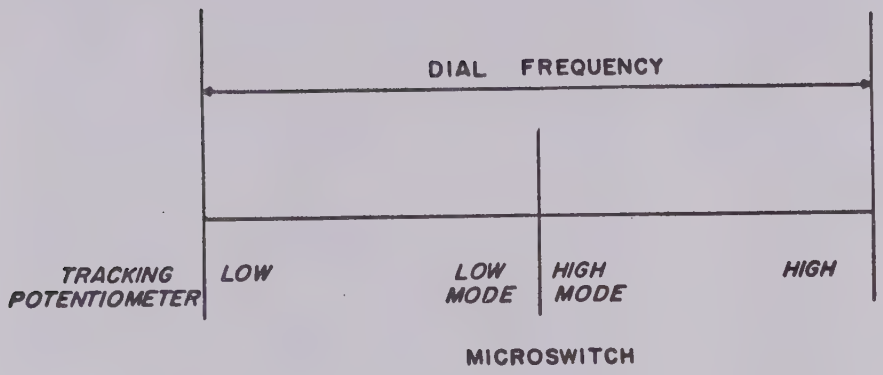


Figure 9-2. Check of Reflector Voltage Variations Against Dial Frequency Variations

8. The following table lists the approximate bias and beam current which are available in each of the tuning units of the Model FIM.

Table 9-1. Values of Bias and Beam Current

Band	Signal Generator			Local Oscillator		
	Tube Type	Bias	Beam Current	Tube Type	Bias	Beam Current
1	5837 or ZV1010	+10V	28 ma	6BM6 5837, or ZV1010	0V +10V	28 ma
2	5836 or ZV1009	+10V	28 ma	6BL6 5836, or ZV1009	0V +10V	28 ma
3	5721 or 6390	+10V	20 ma	5721 or 6390	+10V	20 ma
4	5721 or 6390	+10V	20 Ma	5721 or 6390	+10V	20 ma

b. Before installing a klystron tube, ensure that the cavity contains the proper springs and spacers. In Bands 3 and 4, the forward part of the cavity should contain, in the following order, the knurled nut, spacer, spring, washer, and spring. In Bands 1 and 2, the front of the cavity should contain a knurled nut, a spacer, and a spring. Installation of a klystron tube shall be performed as follows:

1. Check the hats within the Bands 1 and 3 Tuning Units. Make sure that the hats are not bent and that the attenuator and thermistor probes do not come in contact with the hats when the probes are inserted into the cavity.

2. Before inserting a klystron into the Band 3 or Band 4 cavity, it is first necessary to stretch the new springs (if used) 1/4 inch and cut them to the original length.

3. Loosen the knurled nut on the cavity.

4. To preserve a new klystron, use a dummy klystron tube. Reflector top of klystron should be inserted within the cavity inner conductor finger. Slowly push the dummy tube until the ring on the tube is against the springs. Slowly push forward while simultaneously rotating the tube in a clockwise direction. Two clicks should be felt when the tube is properly seated in the cavity. Care should be exercised when placing the tube in the cavity. Do not force or cock the klystron tube when inserting it into the cavity. If the dummy tube seats properly, continue to rotate the tube in a clockwise direction and slowly withdraw the dummy tube from the cavity.

5. Remove the dummy tube completely and insert a new klystron tube, repeating the above procedures with great caution.

6. Tighten the knurled nut, using a spanner wrench.

7. Carefully attach the klystron tube socket to the base of the klystron tube Carefully observe the arrangement of the four pins at the base of the tube and the mating connectors on the tube socket.

CAUTION

DO NOT USE EXCESSIVE FORCE IN REPLACING THE SOCKET ASSEMBLY ON THE BASE OF THE TUBE. IT IS POSSIBLE TO INSERT THE SOCKET IN A MIS-ALIGNED POSITION. THE KLYSTRON TUBE CAN BE PERMANENTLY DAMAGED UNDER THESE CIRCUMSTANCES.

8. Replace the protective shield over the protruding socket of the tube, and secure the shield to the cavity. The closed ends of the slots, at the open end of the shield, should be over the knurled nut, with the shield clamp in its tightened position.

9. To install a new klystron in the Bands 1 or 2 Tuning Units, proceed as follows:

   (a) Remove the knurled nut, spacer, and spring from the cavity.

   (b) Gently insert the klystron tube into the center of the cavity so that the repeller top seats properly with the inner conductor spring fingers. Place spring around ring on klystron, making certain that it seats properly around the ring within the cavity. Replace the spacer.

   (c) Retighten the knurled nut, and attach the socket assembly to the base of the replacement klystron tube.

   (d) Rotate the klystron bias potentiometer completely counterclockwise so that the klystron tube will draw minimum current.

c. To align the cavities of the internal signal generator, set up the equipment as shown in figure 9-3 and proceed as follows:

1. Rotate the appropriate function selector switch to the CAL. SIG. GEN. position.

2. Apply operating power to the equipment.

3. After the beam supply is energized, check the voltages indicated on the Power Unit VOLTMETER.

4. Readjust the screwdriver controls on the Power Unit front panel, if required, to obtain a proper VOLTMETER pointer deflection for the four positions of the VOLTMETER selector switch.

5. Remove modulation, if any, applied to the repeller.

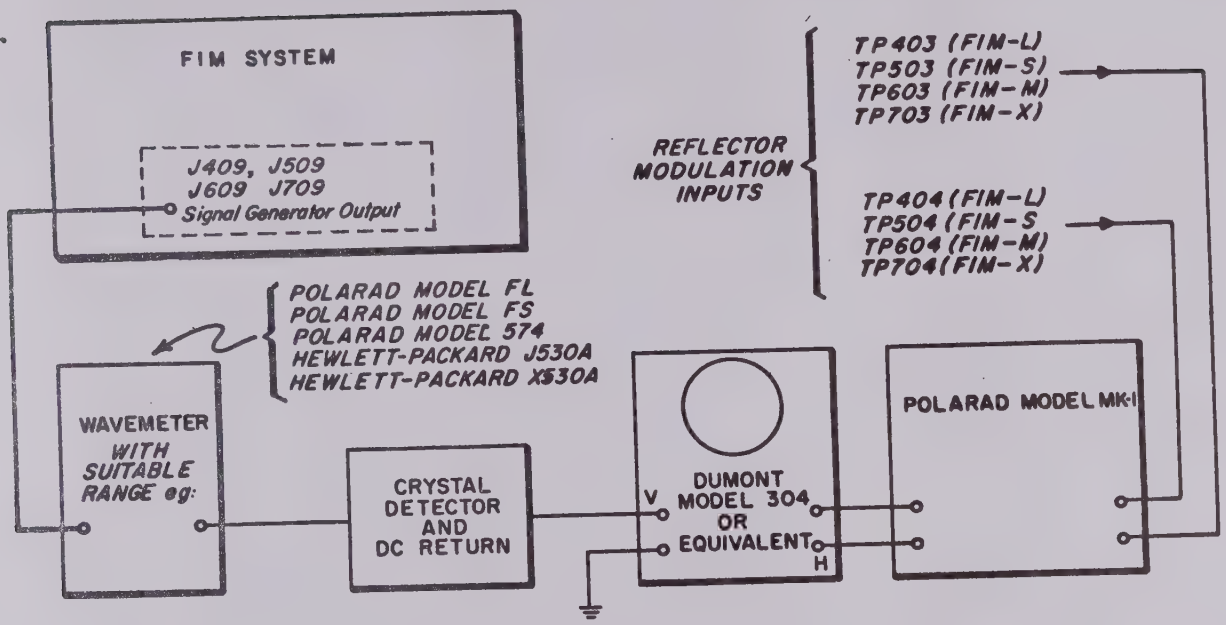


Figure 9-3. Test Setup, Signal Generator Oscillator Alignment

6. Adjust the klystron bias potentiometer for either proper bias voltage or proper beam current as indicated by table 1-1. (For the Bands 1 and 2 Tuning Units, set the bias potentiometer for bias voltage. In Bands 3 and 4, set for beam current.)

7. Rotate the modulation amplitude control (figure 9-3) to obtain a mode pattern on the oscilloscope screen.

8. Center the SIGNAL CALIBRATOR FINE TUNING and COARSE TUNING controls, located on the front panel.

9. Rotate the front panel TUNING control until the signal-generator cam follower is at the fixed point of the adjustable cam, as shown in figure 9-4. Note that the signal-generator cam is close to the reflector potentiometers in the Tuning Units covering Bands 3 and 4, while the signal-generator cam is located close to the TUNING dial in the Tuning Units covering Bands 1 and 2.

10. Tune the wavemeter to obtain a dip in the center of the mode pattern. This dip indicates the true frequency of the klystron oscillator.

11. Vary the signal-generator COARSE frequency adjustment screw, located on the cam follower assembly, to obtain an output frequency equal to that of the frequency dial.

CAUTION

NEVER ATTEMPT TO ADJUST ANY TAB ON THE TUNING CAM UNLESS ALL BOLTS ON THAT SECTION OF THE CAM ARE FIRST LOOSENED. FAILURE TO OBSERVE THIS PRECAUTION WILL RESULT IN SHEARING THE RIVETS THAT SECURE THE TABS TO THE CAM.

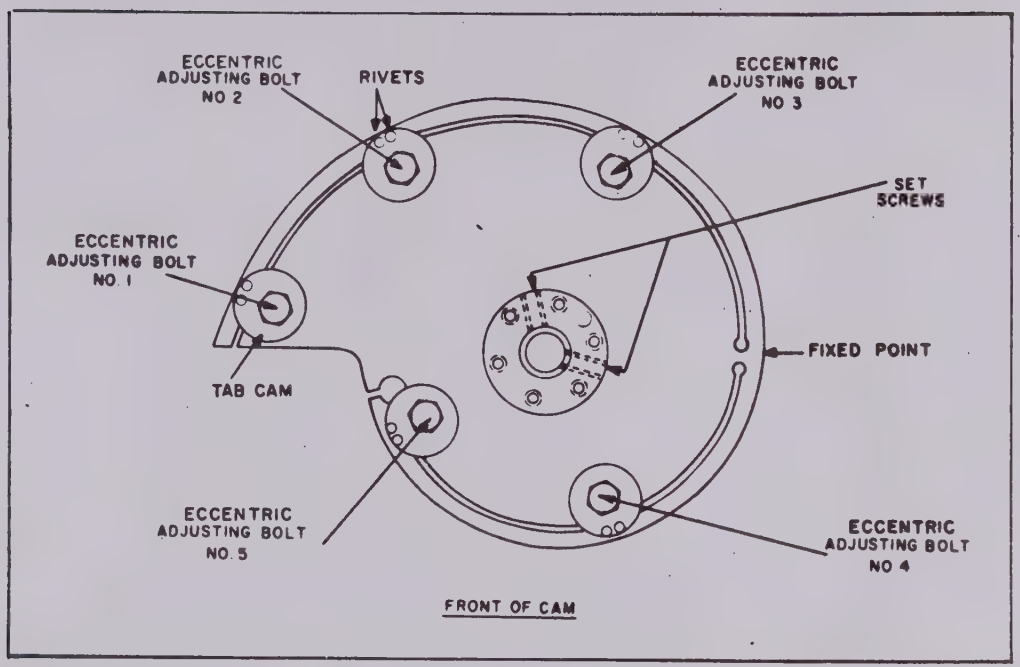


Figure 9-4. Oscillator Adjustable Tuning Cam, Component Location Diagram

12. First adjust the tab closest to the fixed point (tab no. 3, figure 9-4) of the large cam. This tab is adjusted first to avoid damage to the cam.

13. Tighten tab no. 3 and proceed in the following sequence:

    (a) 2nd step: Eccentric No. 2

    (b) 3rd step: Eccentric No. 1

    (c) 4th step: Eccentric No. 4

    (d) 5th step: Eccentric No. 5

14. A number of adjustment controls (one set for the local-oscillator klystron and a second set for the signal calibrator) are accessible at both sides of the tuning unit. Note that Bands 1 and 4 are provided with four controls for each oscillator, since mode switching occurs over the tuning range. Bands 2 and 3 are provided with only two adjustment controls for each oscillator, since there is no need for mode switching in these tuning units. Refer to table 9-2 below for the identification of the various adjustment controls:

Table 9-2. Identification of Tuning Unit Adjustment Controls

Designation	Reference Symbols			
	Band 1	Band 2	Band 3	Band 4
L.O.*LO MODE	R462	Not Applicable	Not Applicable	R762
L.O. HI MODE	R464	Not Applicable	Not Applicable	R764
L.O. LO	R461	R561	R662	R761
L O HI	R458	R558	R661	R758
S.C.*LO MODE	R446	Not Applicable	Not Applicable	R746
S C. HI MODE	R433	Not Applicable	Not Applicable	R746
S.C. LO	R427	R527	R632	R727
S.C. HI	R431	R531	R631	R731

* Note: L.O denotes local oscillator ; S.C. denotes internal signal calibrator.

d. To track the Bands 1 and 4 Tuning Units, proceed as follows:

1. Rotate the tuning dial to immediately below the mode switching point. Center the mode pattern by adjusting the LO MODE potentiometer (table 9-2).

2. Tune to above the mode switching point. Center the mode pattern by adjusting the HI MODE potentiometer (table 9-2).

3. Tune to the high end of the tuning dial and center the mode by adjusting the HI potentiometer (table 9-2).

4. Tune to the low end of the tuning dial and center the mode by adjusting the LO potentiometer (table 9-2).

5. Due to some interaction between controls, it may be necessary to repeat the above procedure for optimum setting of the controls throughout the frequency range.

6. At this point, remove the repeller voltage modulating test setup from the Tuning Unit. Then check the signal-generator cathode current on the Power Unit KLYSTRON CATHODE CURRENT meter (table 1-1) for proper value. Readjust the signal-generator BIAS potentiometer, if necessary, to obtain the proper meter indication.

7. If the mode collapses at the high end of Band 3, loosen the knurled nut, and slowly rotate the klystron tube clockwise to obtain the proper mode pattern. Retighten the knurled nut and place the klystron cover on the cavity. Recheck the modes and frequencies.

8. If rotation of the tube does not help, adjust the small screws located between the pipes on the cavity, to obtain a satisfactory mode pattern. In the Band 4 signal generator, the klystron tube may have to be rotated to give the proper characteristics for obtaining a satisfactory db error.

e. To align the signal calibrator output attenuator, proceed as follows: (See figure 9-5.) (Before proceeding with the alignment of the output attenuator, make certain that both the thermistor-probe and attenuator-probe ground sections are facing toward the klystron tube socket.)

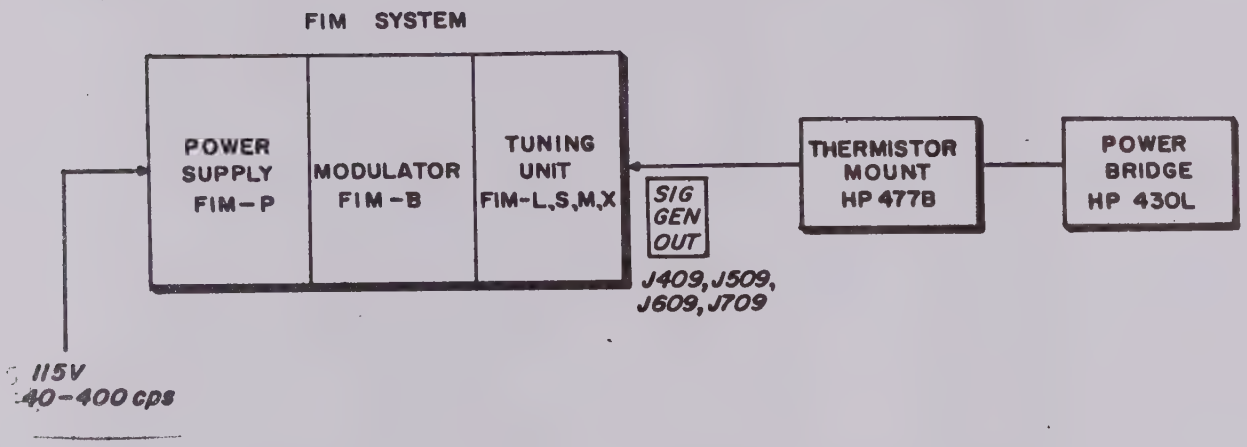


Figure 9-5. Test Setup, Attenuator Alignment

1. Rotate the appropriate function selector switch, on the front panel, to the ZERO SET position.

2. Rotate the METER SELECTOR switch to the POWER MON. position.

3. Rotate the POWER MONITOR ZERO SET control to its maximum clockwise position.

4. Adjust the COARSE bridge adjustment, on the right side of the r-f Tuning Unit, so that the POWER MONITOR meter registers full-scale deflection.

5. Adjust the ZERO SET control so that the POWER MONITOR meter reads zero.

6. Rotate the function selector switch to CAL. SIG. GEN.

7. Rotate the SIGNAL CALIBRATOR OUTPUT ATTENUATOR and POWER SET controls fully counterclockwise.

8. Connect a power bridge, such as the Hewlett Packard Model 430C, using a bolometer or thermistor mount, to the signal-generator attenuator output.

9. Turn the frequency dial to the low end of the band, and rotate the POWER SET control fully clockwise so that maximum power is fed into the POWER MONITOR meter.

10. Loosen the two setscrews holding the thermistor yoke to the power monitor drive, and adjust the position of the thermistor assembly so that when the POWER SET control is fully clockwise, the POWER MONITOR meter will indicate full-scale deflection.

11. Retighten the two setscrews.

CAUTION

CARE SHOULD BE EXERCISED SO AS NOT TO DAMAGE THE HATS ON BANDS 1 AND 3. IF THE HATS ARE BENT OR DAMAGED IN ANY WAY, THE FREQUENCY ALIGNMENT WILL BE VOID.

12. Rotate the frequency dial throughout the range and ensure that the POWER SET control can be varied above and below CAL.

13 Set the frequency dial to the low end of the band.

14. Balance the bridge for a zero set indication.

15. Rotate the SIGNAL CALIBRATOR POWER SET control, with the METER SELECTOR switch in the POWER MON. position, to obtain a CAL indication on the POWER MONITOR meter.

16. Rotate the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control in a clockwise direction to obtain a reading at approximately mid-scale, using the 1-mw range of the power bridge.

17. Note the reading of the attenuator dial. This reading will be used as a reference point.

18. Rotate the TUNING control in a clockwise direction (increasing the frequency) very slowly. At the same time, observe both the variation in pointer deflection on the POWER MONITOR meter and on the power bridge. Look for the following type of variation, in this procedure, in order to determine the points at which further readings will be required:

    (a) Where the POWER MONITOR meter pointer deflects to a peak, while the power bridge pointer deflects to a trough.

    (b) Where the POWER MONITOR meter deflects to a trough, while the power bridge pointer deflects to a peak.

    (c) Where the pointer on the power bridge deflects to a peak or trough, even though the POWER MONITOR meter pointer does not change direction.

    (d) Where the pointer on the POWER MONITOR meter deflects to a peak or trough, even though the pointer on the power bridge does not change direction.

19. At points where data are to be taken, re-zero both the POWER MONITOR meter and the power bridge.

20. Set CAL control and attenuator at the reference point on the attenuator dial and record the reading.

21. If there are no peaks and troughs indicated, or if a large frequency difference between peaks and troughs is noted, then data should be taken at various points throughout the frequency range.

22. After complete data has been taken, the high- and low-power points should be determined and the values substituted in the formula listed below to determine the overall db error.

$$\text{Overall db error} = 10 \log \frac{P_{high}}{P_{low}}$$

23. Substitute the db error calculated in the formula below to find P_{low}:

$$\frac{\text{Overall db error}}{2} = 10 \log \frac{1}{P_{low}}.$$

24. Rotate the frequency dial to the low-power point.

25. Remove the SIGNAL CALIBRATOR OUTPUT ATTENUATOR and POWER SET knobs.

26. Remove the two pilot lamps from the attenuator dial cover.

27. Remove the screw, located between the two control shafts, which secure the attenuator dial cover to the panel.

28. Remove the attenuator dial cover from the panel.

29. To reset the attenuator dial, loosen the two setscrews holding the attenuator dial to the drive shaft.

30. Adjust the power monitor for an indication of CAL on the POWER MONITOR meter.

31. Insert the attenuator probe to the value of the low-power point calculated previously.

32. Slip the attenuator dial so that Odbm lines up with the hairline of the power set window.

33. Tighten both setscrews.

34. Zero set the power monitor bridge and reset CAL, and set attenuator dial to Odbm.

35. Check to see that the reading on the power bridge is the same as that calculated in step 23 for the low-power point.

36. A check of power throughout the frequency band at CAL and Odbm should indicate that the power is centered about 1 mw. If at any point, the attenuator dial will not read Odbm at a POWER MONITOR meter reading of CAL, the stops on the attenuator assembly will require resetting.

f. The test setup for aligning the local-oscillator circuit is the same as that for the signal-generator alignment, except that the r-f power is taken from the mixer, and repeller modulation leads are connected to the local-oscillator repeller modulation-input jacks. R-f power can be taken from the mixer by use of a shorted crystal.

1. The frequency alignment of the local oscillator is the same as that for the signal generator except that the local-oscillator frequency should differ from the dial frequency by 260 mc, in the direction indicated below.

Band	Local-Oscillator Frequency
1	Frequency dial +260 mc
2	Frequency dial +260 mc
3	Frequency dial +260 mc
4	Frequency dial -260 mc

2. Once the frequency and modes have been aligned, the proper crystal should be installed and mixer cables assembled. The chart below indicates the crystals used in each band.

Band	Crystal Type
1	1N23C
2	1N23C
3	1N286 or D979
4	1N286 or D979

3. Connect the output of the crystal mixer to the input of the preamplifier chassis.

4. Rotate the METER SELECTOR switch to the XTAL CUR. position.

5. Adjust the mixer probe so that there is crystal current throughout the frequency range without the modes collapsing. On the Bands 1, 3, and 4 Tuning Units, crystal current is usually the best with the ground of the probe facing the back of the cavity. On the Band 2 Tuning Unit, crystal current is usually the best with the ground of the probe facing the klystron tube socket (front of cavity).

g. For preselector alignment, the following procedure applies to the Band 3 and 4 Tuning Units: (See figure 9-6.) (In Bands 3 and 4, a tape cam correcting device is used for aligning the preselectors. All preselector FINE adjustment screws should be retracted so that they will be flush with the bottom of the casting.)

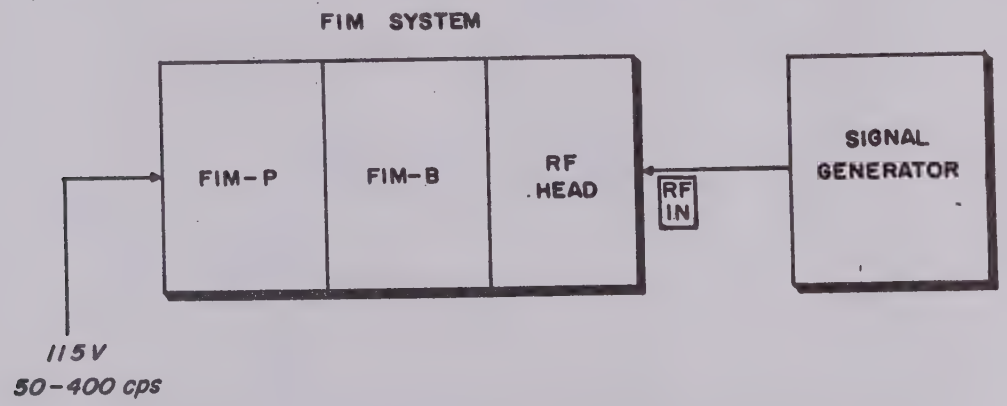


Figure 9-6. Test Setup, Preselector Alignment

1. Set the frequency dial to the high end of the band to a position where the preselector fine adjustment screws are directly over the preselector follower wheel.

2. Adjust the two screws directly above the follower wheel to a position such that they are half way in the casting.

3. Feed an r-f signal into the preselector input.

4. Adjust the signal generator to obtain a peak indication on the output meter.

5. Adjust the two preselector coarse adjustment screws for maximum output.

6. Spotcheck a few points through the band and note curve of the preselector fine adjustment screws. All screws should obtain a peak when inserted into the casting. If the curve is satisfactory, peak all screws at the point where the wheel is directly below the screw.

7. Rotate the frequency dial to the high end of the band. Check sensitivity every 50-mc point. Adjust the screws for the best compromise over the entire band.

h. The Band 1 preselector is aligned by a series of screws which are accessible at the top of the preselector cavity. To align the Band 1 preselector, proceed as follows:

1. Remove the plate from the end of the preselector cavity.

2. All preselector adjustment screws should be retracted from the inside of the preselector cavity and aligned flush with the inside wall.

3. Figure 9-7 illustrates the preselector rods and the fine adjustment screws.

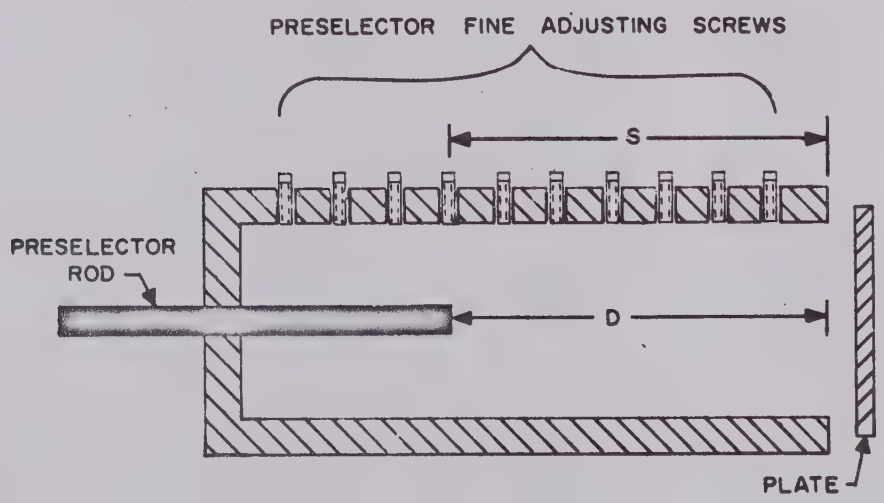


Figure 9-7. Preselector Cavity, Sectional Side View

4. Rotate the frequency dial to the high end of the band and adjust the signal from the generator for maximum output.

5. Adjust the two preselector coarse adjustment screws for a maximum indication on the OUTPUT METER.

6. With the use of a vernier caliper, measure the distance from the tip of the preselector rods to the outside of the cavity (D, figure 9-7).

7. Using the vernier calipers, find the distance (S, figure 9-7) from the screw nearest the tip of the preselector rods, to the end of the cavity casting.

8. Rotate the frequency knob so that the distance from the tip of the preselector rod to the end of the cavity casting will equal distance S, as determined in step 7.

9. Peak up the input signal and adjust the two preselector fine adjustment screws at this position for maximum output.

10. With the aid of the calipers, go from the high end to the low end of the dial and measure and adjust the screws at the points where the preselector rod tips are directly below the screws.

11. The procedure for aligning the preselector should be repeated two or three times, and then the sensitivity should be better than -81 dbm. If the sensitivity is low between adjustment-screw points, the screws may have to be slightly readjusted.

12. After the preselector has been satisfactorily aligned, the plate that is attached to the end of the preselector casting should be installed.

i. The alignment of the Band 2 preselector is the same as that for Band 1, except that the preselector fine adjustment screws should be screwed into the preselector cavity so that the top of each screw is flush with the outer wall of the cavity.

j. To align the AFC CAL adjustment (figure 9-8), proceed as directed below:

1. Remove all signal inputs to the equipment.

2. Set the AFC switch to the OUT position.

3. Rotate the METER SELECTOR switch to the AFC BAL position.

4. Set AFC CAL adjustment R424, located on the Tuning Unit, to give a midscale deflection on the front panel meter.

5. Rotate the AFC switch to the IN position and adjust the front panel AFC control for midscale deflection. (Refer to check of AFC in paragraph 10g.)

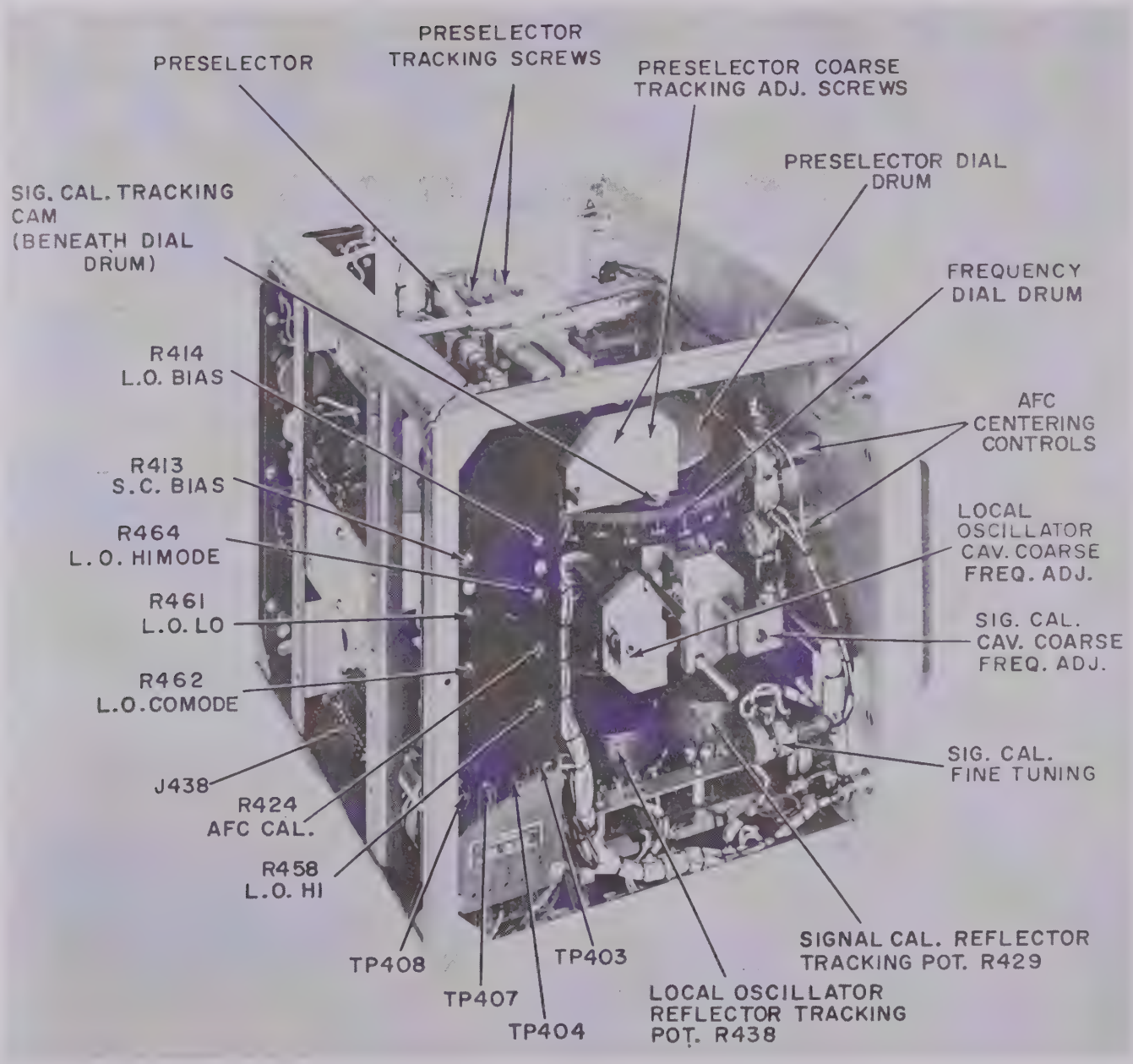


Figure 9-8 Typical Tuning Unit, Right Side View of Chassis

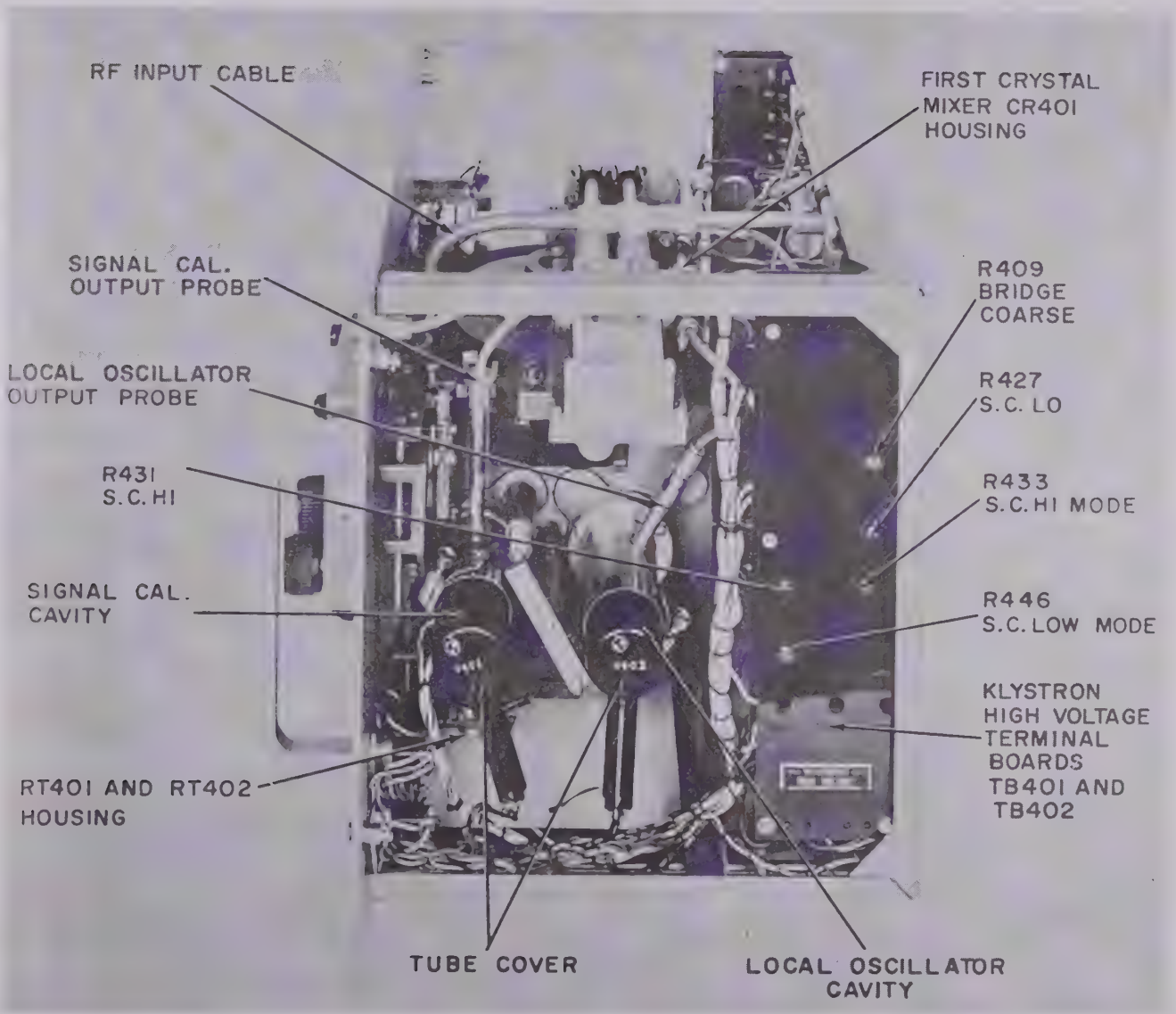


Figure 9-9. Typical Tuning Unit, Left Side View of Chassis

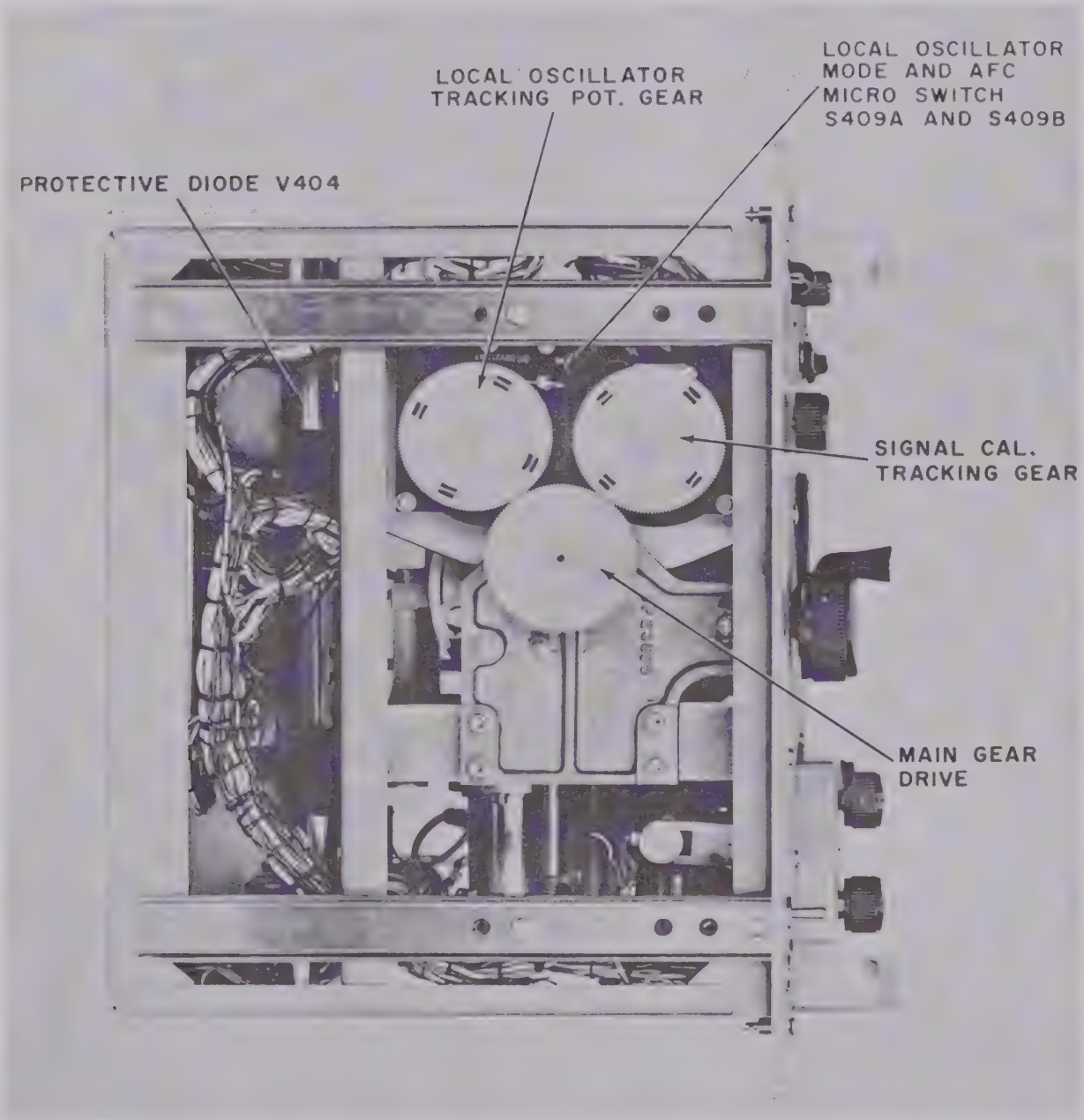
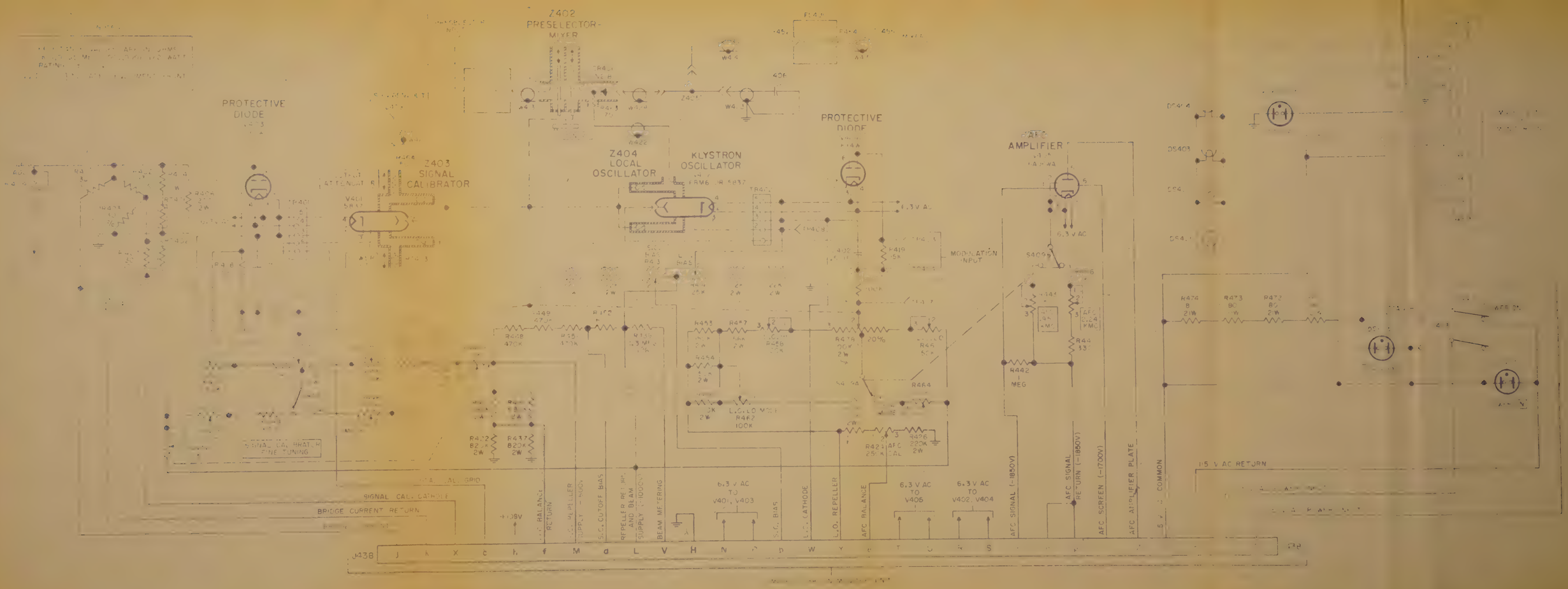


Figure 9-10 Typical Tuning Unit, Bottom View of Chassis



TS-9-11 RAND TUNING UNIT, MODEL FM-L1, SCHEMATIC DIAGRAM

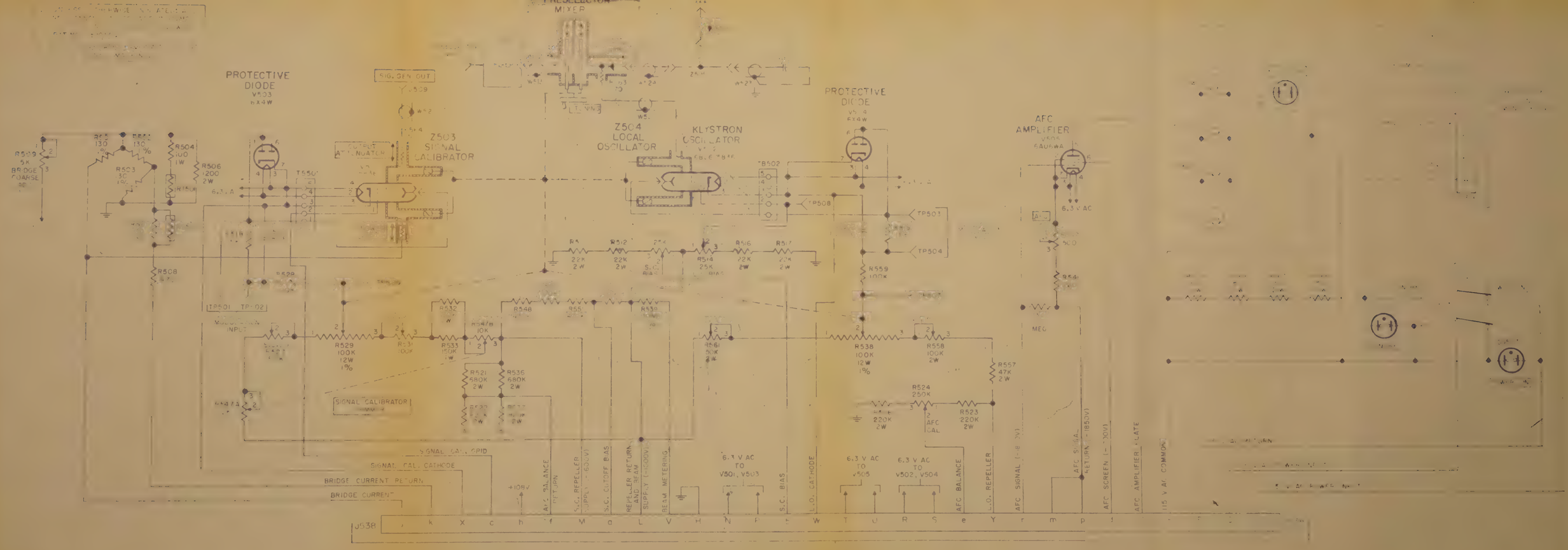
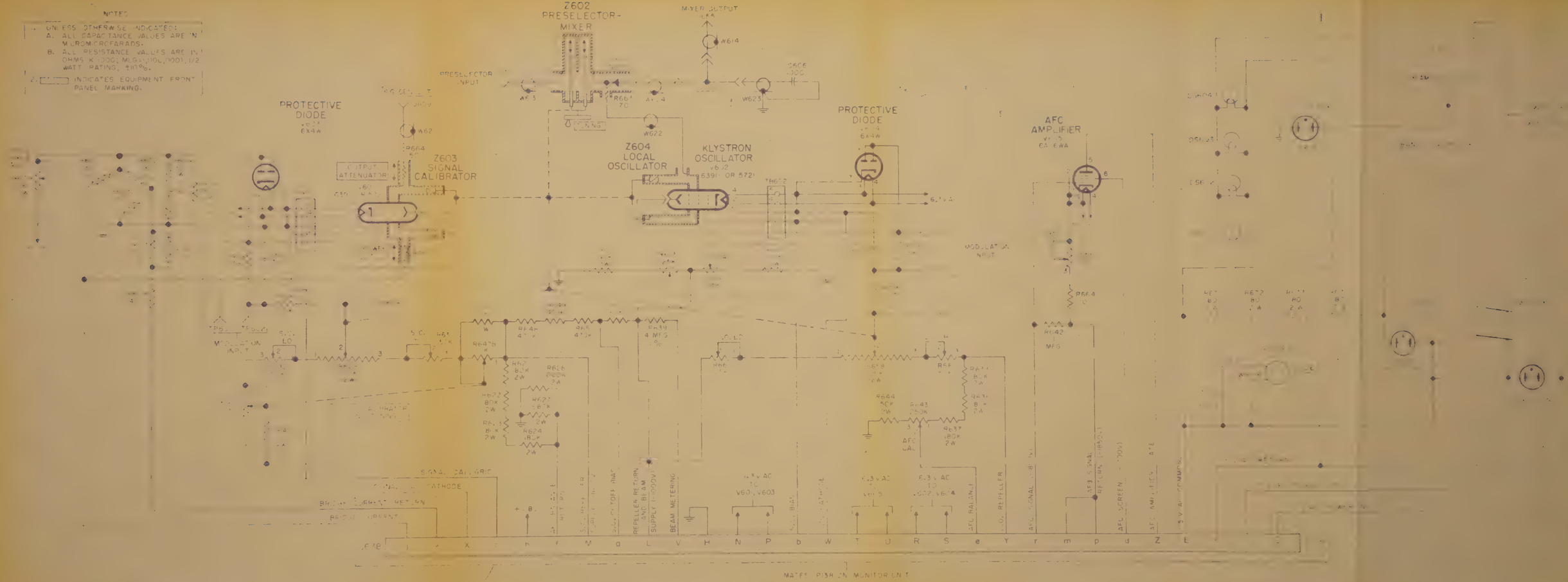


FIGURE 9-12 BAND 2 TUNING UNIT, MODEL FMS, SCHEMATIC DIAGRAM


NOTES:
UNLESS OTHERWISE INDICATED:
A. ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS.
B. ALL RESISTANCE VALUES ARE IN OHMS K (1000), MEG (1,000,000), 1/2 WATT RATING, ±10%.
INDICATES EQUIPMENT FRONT PANEL MARKING.
Z602 PRESELECTOR-MIXER
MIXER OUTPUT
PRESELECTOR INPUT
W614
W623
W622
PROTECTIVE DIODE
V6 J4 6X4W
PROTECTIVE DIODE
V6 J4 6X4W
W62
J609
P664 50
OUTPUT ATTENUATOR
Z603 SIGNAL CALIBRATOR
Z604 LOCAL OSCILLATOR
KLYSTRON OSCILLATOR
V6 J2 6390 OR 5721
TH602
AFC AMPLIFIER
V6 J3 6A EWA
MODULATOR INPUT
R664 70
R642 MEG
R644 50K 2W
R643 250K
R637 180K 2W
AFC CAL.
R641 80K 2W
R622 80K 2W
R623 80K 2W
R624 180K 2W
R627 68K 2W
R626 680K 2W
R625 80K 2W
R638 4 MEG 5%
R639 4 MEG 5%
R647B
R647A
R645
R646
R648
R649
R650
R651
R652
R653
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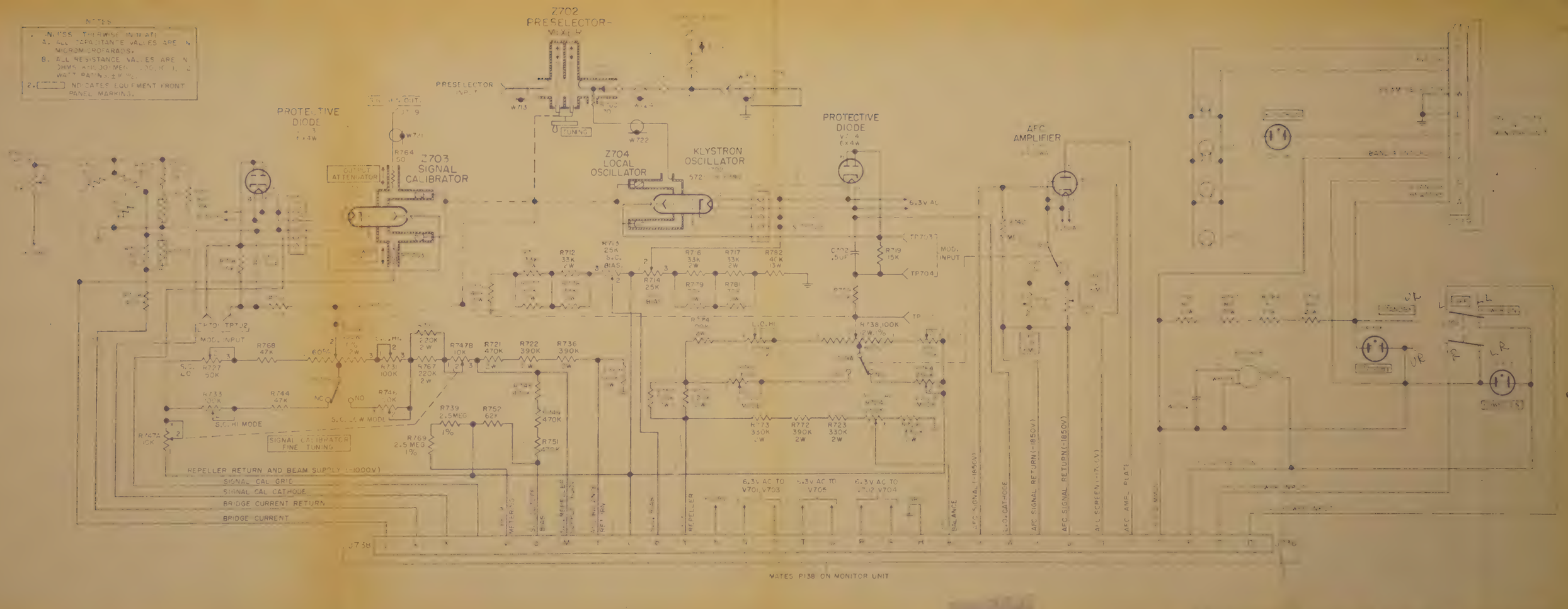

FIG. 9-14 RANGE & TUNING UNIT MODEL 211 SCHEMATIC DIAGRAM

X. FINAL DATA AND CHECKS:

a. Before any final checks are made, ensure that the power supply voltages, including the 93-volt a-c supply and klystron currents are correct. To perform the final checks, proceed as follows:

1. Check the frequency error of each tuning head signal calibrator at every major dial division.

2. Ensure that the COARSE TUNING and FINE TUNING controls are set at "0".

3. Connect the signal-generator output, through a wavemeter, to the power bridge.

4. Tune the wavemeter to cause a sharp dip in the power output.

5. Record the wavemeter frequency at every point of check.

6. The deviation between the wavemeter frequency and the dial frequency of the Tuning Unit should be less than 1%.

b. The following shall be used to check the db error:

1. Use the same method to determine the db error as described in the section on setting the output attenuator.

2. At each point, zero set the POWER MONITOR meter.

3. Adjust the POWER SET control for CAL.

4. Set the OUTPUT ATTENUATOR to Odbm and record the power output.

5. Convert the power at each point to db above or below 1mw and plot a graph of the data obtained. The db error data should indicate that the attenuator is centered about 1mw, Odbm.

c. The following steps indicate the procedure to be followed in checking the sensitivity of the receiver:

1. Ensure that crystal current is continuous throughout the band.

2. Check the scale accuracy in the AVERAGE position by placing the function selector in the CAL. SIG. GEN. position.

3. Adjust the signal calibrator output for 1000 microvolts.

4. Peak this signal for an output indication on the output meter by adjusting the COARSE TUNING and FINE TUNING controls.

5. Adjust the I.F. GAIN control for full scale deflection at 1000 microvolts.

6. As the output of the signal calibrator is reduced, the meter should read a value equal to the OUTPUT ATTENUATOR setting.

7. In checking the overall sensitivity of the receiver, proceed at 50-mc intervals.

8. Set the step attenuator to the Odb position.

9. Set the function selector to the SIGNAL CALIBRATOR position and adjust the COARSE TUNING and FINE TUNING controls for maximum indication on the OUTPUT METER.

10. Set the SIGNAL CALIBRATOR to ZERO and the POWER SET to CAL position.

11. Adjust the I.F. GAIN control for a noise reference reading.

12. Increase the output of the signal calibrator until the reading on the OUTPUT METER rises 3db.

13. The setting of the OUTPUT ATTENUATOR is the receiver sensitivity at this point.

14. After the sensitivity data has been taken throughout the band, a spot check should be made, using an external signal generator feeding into the r-f input. The same sensitivity indications should be found.

d. To check the step attenuator and output attenuator, proceed as follows:

1. This check shall be made at several points throughout the band.

2. Insert an accurate i-f attenuator, such as a Daven type 651R, between the 140 MC IN and 140 MC OUT jacks on the Monitor Unit front panel.

3. Using the signal calibrator, peak the signal so the OUTPUT METER reads full scale when in the 0db position of the step attenuator.

4. Set the step attenuator to the 20db position and note the position of the needle on the OUTPUT METER.

5. Switch back to the 0db position and add attenuation by means of the Daven attenuator. Continue adding attenuation until the OUTPUT METER needle positions itself at the same place it did for the 20db position.

6. The attenuation of the Daven attenuator is equal to the attenuation of the 20db step-attenuator position.

7. Remove the Daven attenuator and switch the step attenuator to the 20db position.

8. Adjust the signal calibrator attenuator for full-scale deflection.

9. Switch the step attenuator to 40db and note the position of the needle on the OUTPUT METER.

10. Switch back to the 20db position and add attenuation by means of the Daven attenuator. Continue this until the OUTPUT METER falls in the same position as that for step 9, above.

11. The attenuation of the Daven attenuator plus the attenuation of the 20db step attenuator is equal to the attenuation of the 40db step attenuator.

12. In a similar manner, check the attenuation of the 60db and 80db step attenuators.

e. Perform the following steps to check the Monitor Unit:

1. Check the scale accuracy and slideback control by following the instructions in the monitor alignment section.

2. In order to check the external modulation input, feed a square wave of approximately 25 volts in amplitude and approximately 1 kc in frequency into the EXT. MOD. input jack on the front panel.

3. Connect a crystal detector to the signal-generator output and a d-c oscilloscope to the detector.

4. Set the function selector to the CAL. SIG. GEN. position. A square wave should appear on the oscilloscope.

5. The d-c level of the square wave should be constant and independent of whether modulation is present or not.

6. The oscilloscope connected to the VIDEO OUT jack on the front panel should indicate the modulation present.

f. To check the aural tuning aid, proceed as directed below:

1. Obtain a meter deflection from a c-w signal such as the output of the signal calibrator.

2. Connect a headset to the AUDIO OUT jack.

3. By means of the aural tuning aid, it should be possible to detect the presence of a c-w signal as you tune through the band.

g. To check the AFC, proceed as follows: (Refer to paragraph 9j.)

1. Set the POWER MONITOR meter to the AFC BAL position, and rotate the AFC switch to OUT.

2. Feed a signal from the signal calibrator into the receiver.

3. Carefully peak the signal by means of the COARSE TUNING and FINE TUNING controls.

4. Rotate the AFC switch to the IN position. The POWER MONITOR meter should remain near midscale and the signal should hold on the meter scale.

5. As the FINE TUNING control is varied over a small range, the signal should remain at maximum on the OUTPUT METER and the POWER MONITOR meter should vary both sides of center scale.

h. To check the equipment for image rejection, proceed as directed below:

1. Adjust a signal generator to the receiver fundamental frequency and measure the sensitivity at that point.

2. Adjust the generator frequency to the receiver's fundamental frequency $\pm$520 mc, depending upon which band is being tested. The chart below lists the image frequency for each band.

Band	Image Frequency
1 2 3	dial frequency +520mc
4	dial frequency -520mc

3. Peak the signal and measure the sensitivity.

4. The difference in sensitivity of the two signals is equal to the image rejection. The image rejection should be equal to or better than 60 db.

i. Check the recorder output by the following method:

1. Insert a 0-1 milliammeter into the RECORDER OUT jack.

2. Note whether the milliammeter indication varies as the OUTPUT METER varies.

THE MODEL FIM MICROWAVE FIELD INTENSITY METER

VOLTAGE MEASUREMENTS TAKEN WITH 1,000 OHM-PER-VOLT METER

(All voltages are dc, unless otherwise noted, and are measured to chassis ground.)

TUBE	PIN NUMBER								
	1	2	3	4	5	6	7	8	9
V1	0	+1.75	6 ac	0	+110	+105	+1.75	-	-
V2	0	+1.75	6 ac	0	+105	+100	+1.75	-	-
V3	0	+1.75	6 ac	0	+105	+ 95	+1.75	-	-
V4	0	+1.875	6 ac	0	+115	+ 95	+1.875	-	-
V5	0	+2.25	6 ac	0	+115	+110	+2.25	-	-
V6	0	+2.25	6 ac	0	+115	+110	+2.25	-	-
V7	0	+2.0	6 ac	0	+105	+125	+2.0	-	-
V8	0	+6.0	6 ac	0	+125	+125	+6.0	-	-
V9	+0.625	0	6 ac	0	+0.125	0	0	-	-
V10	+0.25	0	+3	6 ac	6 ac	+125	0	3	0
V11	0	+1.0	6 ac	0	+125	+125	+1.0	-	-
V12	0	+1.0	6 ac	0	+125	+125	+1.0	-	-
V13	0	0	6 ac	0	+17.5	+ 40	0	-	-
V14	0	0	6 ac	0	+ 40	+ 42	0	-	-
V15	0	+1.0	0	6 ac	+125	+125	+1.0	-	-
V16	0	+1.0	0	6 ac	+115	+115	+1.0	-	-
V17	+125	0	+1.25	0	0	+125	+1	+1	6 ac
V18	-.25	+2.25	6 ac	0	+125	+115	+2.25	-	-
V19	-4.0	+2.0	6 ac	0	+125	+115	+2.0	-	-
V20	-6.5	+2.25	6 ac	0	+125	+105	+2.25	-	-
V21	+125	+ 25	+ 30	6 ac	6 ac	+125	+ 25	+ 30	0
V22	0	+1.25	6 ac	0	+ 25	+ 40	+1.25	-	-
V23	+110	+110	6 ac	0	0	0	+1.5	-	-
V24	+110	+110	6 ac	0	0	0	+1.75	-	-
V25	+ 45	0	+0.25	6 ac	6 ac	0	0	0	0
V26	0	+ 55	0	6 ac	+100	+105	0	-	-
V201	0	+320	0	265 ac	0	250 ac	+320	-	-
V202	0	- 5	0	-325	0	-325	0	-	-
V203	- 85	+250	- 25	0	- 85	-	-	-	-
V204	0	- 85	0	- 85	0	- 20	- 85	-	-
V205	- 85	-175	- 75	-175	- 85	- 75	-175	-	-
V206	- 25	- 90	- 85	- 85	- 85	-90	-175	-175	- 85
V207	100 ac	0	2 ac	2 ac	0	100 ac	0	-	-
V208	0	+220	0	-500	0	-500	+215	-	-

VOLTAGE MEASUREMENTS TAKEN WITH 1,000 OHM-PER-VOLT METER (cont)

TUBE	PIN NUMBER								
	1	2	3	4	5	6	7	8	9
V209	0	-475	0	-1150	0	-1150	-475	-	-
V210	- 30	- 25	- 25	- 25	+250	+250	- 25	-	-
V211	-350	-325	-400	-400	- 25	- 25	-350	-	-
V212	-350	-400	-400	-400	-400	-400	-500	-500	-400
V213	-325	-425	-300	-400	-325	-300	-425	-	-
V214	-425	-500	-500	-500	-425	-480	-490	-	-
V215	-900	-1025	-850	-1025	-900	-825	-1025	-	-
V216	-1025	-1150	-1025	-1150	-1025	-1000	-1150	-	-
V217	0	+340	0	420 ac	0	420 ac	0	+340	-
V218	0	+340	0	420 ac	0	420 ac	0	+340	-
V219	-575	-110	80 ac	80 ac	0	-570	440 ac	-	-
V220	+55	+285	+130	+ 55	+285	+130	-325	-325	-
V221	+55	+285	+135	+ 55	+285	+130	-325	-325	-
V222	0	0	0	-105	0	0	-105	-	-
V223	0	0	-325	-325	+ 55	+ 45	0	-	-
V224	+105	0	0	0	+105	0	0	-	-

	TUBE ELEMENT	
	CATHODE	PLATE
V801	+0.5	+120
V802	+0.5	+120

ADJUSTMENT AND ALIGNMENT PROCEDURES FOR

THE MODEL FIM MICROWAVE FIELD INTENSITY METER

VOLTAGE MEASUREMENTS TAKEN WITH 20,000 OHM-PER-VOLT METER

(All voltages are dc, unless otherwise noted, and are measured to chassis ground.)

TUBE	PIN NUMBER								
	1	2	3	4	5	6	7	8	9
V1	0	+1.7	6 ac	0	+110	+102	+1.7	-	-
V2	0	+1.8	6 ac	0	+107	+100	+1.8	-	-
V3	0	+1.75	6 ac	0	+105	+ 95	+1.75	-	-
V4	0	+1.82	6 ac	0	+115	+ 95	+1.85	-	-
V5	0	+2.3	6 ac	0	+115	+112	+2.3	-	-
V6	0	+2.3	6 ac	0	+115	+112	+2.3	-	-
V7	0	+2.1	6 ac	0	+105	+125	+2.1	-	-
V8	0	+6.2	6 ac	0	+125	+125	+6.2	-	-
V9	+0.65	0	6 ac	0	+0.05	0	0	-	-
V10	+125	0	+3	6 ac	6 ac	+125	0	3	0
V11	0	+0.95	6 ac	0	+125	+125	+0.95	-	-
V12	0	+1.1	6 ac	0	+125	+125	+1.1	-	-
V13	0	0	6 ac	0	+ 17	+ 39	0	-	-
V14	0	0	6 ac	0	+ 39	+ 42.5	0	-	-
V15	0	+1.05	0	6 ac	+125	+125	+1.05	-	-
V16	0	+0.85	0	6 ac	+115	+115	+0.85	-	-
V17	+125	0	+1.25	0	0	+125	+1	+1	6 ac
V18	-0.2	+2.25	6 ac	0	+125	+115	+2.25	-	-
V19	-4	+1.9	6 ac	0	+125	+115	+1.95	-	-
V20	-6.4	+2.2	6 ac	0	+125	+105	+2.25	-	-
V21	+125	+23	+31	6 ac	6 ac	+125	+23	+31	0
V22	0	+1.35	6 ac	0	+ 23	+ 41	+1.35	-	-
V23	+107	+107	6 ac	0	0	0	+1.5	-	-
V24	+107	+107	6 ac	0	0	0	+1.75	-	-
V25	+ 45	0	+0.25	6 ac	6 ac	0	0	0	0
V26	0	+ 56	0	6 ac	+100	+105	0	-	-
V201	0	+320	0	265 ac	0	250 ac	+320	-	-
V202	0	- 5	0	-325	0	-325	0	- 5	-
V203	- 85	+280	- 22	0	- 85	-	-	-	-
V204	0	- 85	0	- 85	0	- 20	- 85	-	-
V205	- 87	-175	- 75	-175	- 85	- 77	-175	-	-
V206	- 22	- 90	- 85	- 85	-87	- 89	-175	-173	- 86
V207	100 ac	0	2 ac	2 ac	0	100 ac	0	-	-
V208	0	+220	0	-490	0	-490	+215	-	-

ADJUSTMENT AND ALIGNMENT PROCEDURES FOR

THE MODEL FIM MICROWAVE FIELD INTENSITY METER

VOLTAGE MEASUREMENTS TAKEN WITH 20,000 OHM-PER-VOLT METER (cont)

TUBE	PIN NUMBER								
	1	2	3	4	5	6	7	8	9
V209	0	-470	0	-1170	0	-1170	-480	-	-
V210	- 30	- 25	- 25	- 24	+240	+240	- 25	-	-
V211	-345	-325	-410	-410	- 23	- 25	-345	-	-
V212	-340	-410	-410	-410	-410	-410	-500	-500	-410
V213	-325	-420	-310	-410	-325	-310	-420	-	-
V214	-420	-490	-490	-500	-420	-400	-490	-	-
V215	-910	-1020	-840	-1020	-910	-830	-1020	-	-
V216	-1020	-1160	-1020	-1160	-1020	-980	-1160	-	-
V217	0	+340	0	420 ac	0	420 ac	0	+340	-
V218	0	+340	0	420 ac	0	420 ac	0	+340	-
V219	-570	-107	80 ac	77 ac	0	-570	440 ac	-	-
V220	+ 57	+285	+130	+ 57	+287	+130	-325	-325	-
V221	+ 57	+285	+132	+ 57	+287	+130	-325	-325	-
V222	0	0	0	-105	0	0	-105	-	-
V223	0	0	-325	-325	+ 55	+ 45	0	-	-
V224	+105	0	0	0	+105	0	0	-	-

	TUBE ELEMENT	
	CATHODE	PLATE
V801	+0.5	+120
V802	+0.45	+120

ADJUSTMENT AND ALIGNMENT PROCEDURES FOR

THE MODEL FIM MICROWAVE FIELD INTENSITY METER

RESISTANCE MEASUREMENTS

(All measurements are to chassis ground.)

TUBE	PIN NUMBER								
	1	2	3	4	5	6	7	8	9
V1	10 meg	200	.2	0	25 K	35 K	200	-	-
V2	0	200	.2	0	25 K	35 K	200	-	-
V3	0	200	.2	0	20 K	34 K	200	-	-
V4	0	300	.2	0	24 K	50 K	300	-	-
V5	7.5 meg	300	.2	0	24 K	30 K	300	-	-
V6	10 meg	300	.2	0	25 K	30 K	300	-	-
V7	0	250	.2	0	22 K	27 K	250	-	-
V8	0	150	.2	0	20 K	20 K	150	-	-
V9	500	0	.2	0	6.4 K	0	INF.	-	-
V10	20 K	550 K	10 K	.2	.2	20 K	550 K	10 K	0
V11	2 K	100	.2	0	9 K	9 K	100	-	-
V12	6 K	100	.2	0	9 K	9 K	100	-	-
V13	11 K	0	.2	0	30 K	9.5 K	0	-	-
V14	15 K	0	.2	0	30 K	9.5 K	0	-	-
V15	4.8 K	100	0	.2	9 K	9 K	100	-	-
V16	4.8 K	100	0	.2	10 K	10 K	100	-	-
V17	20 K	14 K	200	0	0	20 K	0	200	0.3
V18	20 K	200	.2	0	20 K	25 K	200	-	-
V19	34 K	200	.2	0	20 K	25 K	200	-	-
V20	20 K	200	.2	0	20 K	25 K	200	-	-
V21	22 K	480 K	4.8 K	0.2	0.2	20 K	480 K	4.8 K	0
V22	110 K	4.8 K	0.2	0	500 K	840 K	4.8 K	-	-
V23	24 K	25 K	0.2	0	5 meg	5 meg	115 K	-	-
V24	24 K	24 K	0.2	0	0	0	115 K	-	-
V25	65 K	50 K	300	0.2	0.2	INF.	INF.	INF.	0
V26	450 K	500	0	0.2	25 K	25 K	450 K	-	-
V201	INF.	INF.	INF.	INF.	INF.	INF.	INF.	INF.	-
V202	INF.	INF.	INF.	INF.	INF.	INF.	INF.	INF.	-
V203	INF.	0.18 M	0.15 M	0	INF.	-	-	-	-
V204	0	INF.	INF.	INF.	0	INF.	INF.	-	-
V205	INF.	INF.	INF.	INF.	INF.	INF.	INF.	-	-
V206	0.15 M	68 K	INF.	INF.	INF.	68 K	INF.	INF.	INF.
V207	0.18 M	INF.	3	2	INF.	0.19 M	0	-	-
V208	INF.	INF.	INF.	INF.	INF.	INF.	INF.	INF.	-

ADJUSTMENT AND ALIGNMENT PROCEDURES FOR

THE MODEL FIM MICROWAVE FIELD INTENSITY METER

RESISTANCE MEASUREMENTS (cont)

TUBE	PIN NUMBER								
	1	2	3	4	5	6	7	8	9
V209	INF.	INF.	INF.	INF.	INF.	INF.	INF.	INF.	-
V210	INF.	INF.	INF.	INF.	INF.	INF.	INF.	-	-
V211	INF.	INF.	INF.	INF.	INF.	INF.	INF.	-	-
V212	INF.	INF.	INF.	INF.	INF.	INF.	INF.	INF.	INF.
V213	INF.	INF.	INF.	INF.	INF.	INF.	INF.	-	-
V214	INF.	INF.	INF.	INF.	INF.	INF.	INF.	-	-
V215	INF.	INF.	INF.	INF.	INF.	INF.	INF.	-	-
V216	INF.	INF.	INF.	INF.	INF.	INF.	INF.	-	-
V217	INF.	0.18 M	INF.	52	INF.	52	INF.	0.18 M	-
V218	INF.	0.18 M	INF.	52	INF.	52	INF.	0.18 M	-
V219	INF.	INF.	INF.	INF.	INF.	INF.	48	-	-
V220	0.53 M	0.18 M	INF.	0.53 M	0.18 M	INF.	INF.	INF.	-
V221	0.53 M	0.18 M	INF.	0.53 M	0.18 M	INF.	INF.	INF.	-
V222	0	INF.	INF.	INF.	0	INF.	INF.	INF.	-
V223	INF.	0	INF.	INF.	0.53 M	30 K	0	-	-

	TUBE ELEMENT	
	CATHODE	PLATE
V801	53	20 K
V802	56	22 K

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